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Conference on Domestic Hygiene.
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FROM A PHOTOGRAPH TAKEN AT THE CONGRESS OF THE INSTITUTE HELD AT NEWCASTLE-ON-TYNE IN 1896.

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JOURNAL
OF
THE SANITARY INSTITUTE.

DISCUSSION ON

THE COLLECTION, DISPOSAL, AND UTILIZATION OF TOWN REFUSE IN LEICESTER.

Opened by F. W. ALLEN, Assoc.M.Inst.C.E.,
Assistant Borough Surveyor, Leicester.

At Provincial Sessional Meeting at Leicester, December 5th, 1903.

THE subject which I have the honour to bring before you to-day by the favour of the Borough Engineer, although it may not be a very attractive one, is still full of interest to the sanitarian. As the pathologist does not shrink from probing to their depths the nature and cause of disease, so it is necessary that we should treat with equal thoroughness one of the most important methods for its prevention.

Repulsive as it may appear in many of its details, it is, I venture to state, second in importance to none of the problems which face those who have the health of our large communities at heart.

Those of you who have been connected with the administration of the Public Health Acts for a period of thirty years or so and have observed the antecedents of disease, will agree that a population living amid conditions of faulty domestic sanitation cannot continue healthy.

It is a case of the survival of the fittest. The strong withstand the pernicious effects of impure air for a more or less extended period; but their general health is gradually undermined. The weakly and susceptible succumb with a readiness which is only too familiar in our more densely populated districts.

Atmospheric impurity, owing to the presence of decaying animal and vegetable matter or the emanations from cesspools, is a fruitful source of

disease and the removal of these sources of pollution is followed by a corresponding diminution of sickness.

For sanitary reasons, therefore, three courses of action are imperative.

(1) All excreta should be removed from dwellings immediately, and the removal should be carried out in the most economical method and with the least possible annoyance. Water carriage is no doubt the best and cheapest means of transport; but this method of disposal is a subject which does not come fairly within the scope of this paper.

(2) House refuse with all its animal and vegetable matter, and trade refuse, including offal from fish-shops and slaughter-houses, decaying fruit, market refuse, etc., should be dealt with systematically and with the minimum of handling.

The disposal of the conglomeration of more or less foul matters is no slight undertaking, and, when one looks back to the time when such materials were tipped into worked out clay and sand-pits, one wonders how the people, who subsequently lived in the houses built thereon, enjoyed anything like a reasonable freedom from sickness.

The proper system is, I submit, destruction by fire.

(3) Street cleansing should be executed in such a manner as to secure the most thorough removal of surface filth and decomposing matters, and should be regularly carried out under the best possible conditions as regards men, materials and plant.

To facilitate this process, impervious, well-laid and properly drained pavements and a good supply of water are of the first importance.

It may be interesting to trace the progress of Leicester in its endeavours to attain these ideals.

Leicester is on the line of the Roman Via Devana, and the older parts of the town are built on the site of a Roman camp.

Occasional finds of broken Samian, or other ware, deposited in wells (or cesspools perhaps), and in "made" ground, where clay or sand had been excavated, seem to point to the conclusion that the Romans adopted much the same method of refuse disposal as obtained in Leicester in 1851.

Our reputation for rapid progress would seem, therefore, to be of somewhat recent growth.

At this latter period, then, our town, with its population of 60,000 persons, a total area of 3,030½ acres, and a built area of (say) 600 acres exhibited all the worst conditions.

Being an old walled town, its streets were narrow and tortuous, and paved with cobbles and pebbles. Its houses were crowded, its yards confined in area and paved, where paved at all, with pebbles.

A total lack of proper sewerage; the abominable privy system in full swing with all its offensive appendages of deep, open, reeking cesspool or covered vault; open, deep manure pits; a water supply, obtained for the most part from shallow surface wells placed, as usual, in close proximity to the cesspools; no proper system of refuse removal, the farmers attending to the cesspools, vaults, etc., when it suited them best (their leaky waggons frequently leaving a filthy ill-smelling trail through the streets after the night's work); these were the environments of the Leicester man fifty years ago.

Thus it came about that during the hot months of July and August, when the diarrhœa scourge would be at its height, the town was in the most unhealthy condition.

There were also in the oldest and most densely populated parts of the town no fewer than 104 slaughterhouses (1 to every 600 persons), with large open cesspools or manure-pits, on which pigs were kept in some instances for the consumption of blood and offal; many of the slaughterhouses were without any drains whatever, the scourings of their yards being traceable over undrained and badly paved streets for a considerable distance before finding an exit by a more or less direct route through the old shallow box drains, which did duty as sewers, into the river.

At a moderate computation therefore there must have been an area of reeking filth equal to something like three acres.

There is no record of street cleansing in those days; but some years later the cleansing was let to working contractors, who usually worked a whole district with a small cart and a patient donkey.

Add to this the fact that July floods very often covered a considerable portion of the built area in the West end, leaving a filthy deposit of mud in street and dwellings, and I think everyone will agree that the death rate of 24·9 per 1000 (a percentage of 29·5 under one year of age) was under the circumstances not to be wondered at.

The first attempt to remedy this condition of things was made about the year 1849, after the passing of the Public Health Act of 1848, when Mr. Thos. Wicksteed, C.E., was called in to design a system of sewers and sewage disposal.

Sewers were laid, works were executed at a cost of some £40,000 between 1854–8, and water closets were introduced in large numbers.

Owing however to defective construction (in the light of modern practice) and the bad outfall, the sewers in some districts became silted up.

The borough engineer in his report of June, 1898, describes the condition of thirty miles or so of these sewers and the defects very graphically.

Owing to these difficulties of sewerage, the pail system was introduced about the year 1871, and many of the water closets and privies were converted into pail closets, the cesspools being filled up and used as ashpits.

Pails were provided by the Corporation at a cost of 10s. 6d. each to the property owner, the Corporation renewing the pails from time to time, as required, without further charge. They also undertook the collection and disposal of the contents.

This obtained until the year 1882, after which date no plans were approved shewing anything but water closets.

From this date also open dust-pits and manure-pits were gradually roofed in and ventilated and reduced in dimensions where of large area, and new ones were constructed of very small area, paved at yard level, and similarly roofed in and ventilated. Needless to say, the emptying of these confined dust-pits was anything but a healthy occupation, either when very wet (as they frequently were by reason of the throwing in of slops) or when very dry and dusty. Portable dust bins were also provided in isolated cases where the refuse had to be carried through dwelling houses.

In 1886 a sort of unofficial commencement was made in the introduction of a general portable bin system by persuading builders and architects depositing plans to adopt bins in all new property. In many cases the roofed dust-pits were altered and bins provided, the old dust-pit being used as a coal or store place, or sometimes as a bin shed.

The Floods Prevention Works, the New Main Trunk Sewers and the Sewage Farm were also making good progress, and better facilities for the installation of a complete water carriage system were coming into view.

The following particulars as to the borough in 1886 may be of interest:—

Total area	...	...	3,030	acres.
Built area	...	...	1,300	„
Population	...	...	131,976	
Miles of streets	...	...	74	
Houses ...	...	...	26,934	
Water closets	...	...	13,821	
Pail closets	...	...	6,500	

Privies	200
Ash-pits	11,500, from which 38,497 tons of refuse were removed.
Slaughter-houses ...	70
Cow-sheds	173
Wells	361, supplying a population of 3,800 persons.

Plant for Refuse Collection and Disposal—

5 canal boats.	26 railway wagons.
13 pail collecting vans.	2 nightsoil carts.
40 ash carts.	8 box wagons.
7,000 pails (working stock).	

Employing 118 men and 46 horses.

A portion of the house refuse was carted away to tips (some now built on). The precautions taken in covering these tips with 10 ft. or so of earth, and the enforcement of a layer of concrete over the whole site of each house appears to have been effectual. Another portion was mixed with manure, and still another portion was screened through a grid having bars spaced $1\frac{1}{2}$ inches apart.

By screening—

9·7 % of garbage etc., was separated and used as manure.
6·45 % of hard stuff and tins, glass, etc.
83·85 % of fine ashes.

It was anticipated that farmers would cart away the last for top dressing; but the expectations were not realized, and the system was abandoned.

The system of collection was as follows:—Ten sets of three men paid at the rate of 5d. per load per man, the horse, two carts and one driver being provided by the corporation.

Three other sets were employed in trade refuse collection.

The practice then was to have a standing cart while the loaded one was being taken to the tip, a practice which, I need hardly say, was open to serious objections and caused numerous complaints.

Some years later the standing cart was horsed, so that a gang or set of ash-pit emptiers consisted of two fillers and two working wagoners, all paid at the rate of 5d. per load per man, the wagoners having an extra 2s. a week for stable duty.

There was a cessation of complaints and an increase in the quantity of stuff collected; but the cost per load was more.

At this time we found that a load of wet house refuse from ashpits contained about 1¼ cube yards and weighed about 58 lbs. per cubic foot, while ordinary bin refuse weighed 55 lbs. per cubic foot. The quantity per house per annum amounted to 55 cubic feet and the weight to 28 cwt.

In pail collection 10 sets of 2 men were employed, and they were paid at the rate of 1s. per load of 24 pails per man. Each pail yielded a weight of 47 lbs. per week, or 22 cwt. per annum.

The total cost of nightsoil, pail, and house, refuse collection and disposal was	£11,850	per annum.
(Equals 1/9·55 per head).		
Receipts from sales of manure, etc.	£3,500	do.
(Equals -/6·36 per head).		
Net cost	£8,350	do.

(Equals 1/3·19 per head, or £112 17s. per mile of street).

The prices obtained for manure were:—

For mixed manure, 2s. 6d. per ton on rail.

For pail contents, 23s. per wagon, delivered in fields per box wagon.

The private slaughterhouses, which had now been reduced to seventy within the borough, had still in many instances deep manure-pits which were very offensive. Constant pressure at length caused the butchers to form an association to undertake the frequent removal of refuse, and they have carried out the work more or less successfully ever since.

Street Cleansing.—There were at this period some seventy-four miles of streets, which were swept and cleansed from once to three times a week, and once a day in central thoroughfares. The work employed twenty-six men and twelve horses. The total cost was about £3,600 a year, or £48 12s. per mile per annum.

The great bulk of the carriageways at this period were either macadamized or random paved (without grouting), although a better state of things had been inaugurated some years before by the laying of granite sett grouted pavements in several public streets, and by the laying of uncreosoted deal pavements on the "Norwich" system in other public streets.

These wood pavements soon became nuisances. As the blocks were

not bedded hard on a concrete surface they wore into holes, and it became impossible to scavenge them satisfactorily.

The surface of the blocks, through the bruising of the fibre, acquired a sponge-like composition in wet weather, so that as a vehicle passed along, the absorbed water squirted out and sprinkled shop windows and foot passengers impartially.

The Borough was extended in 1891, so as to include an area of 8,586 acres and a population of 177,000.

Upon making a sanitary survey of the added areas a huge number of defects were found, and the primitive privy and pail pressed themselves into notice once more. Some cesspools had not been emptied for nine years, and in very many instances closets were without pails, buckets, tea-trays, biscuit tins, tubs, boxes, and all sorts of odd things doing duty.

There was no proper system of collection, and many tenants had to bury the excreta in their limited gardens.

In 1892 the construction of the main trunk sewers, designed by the late Mr. Joseph Gordon, M.Inst.C.E., the laying out of the sewage farm, and the installation of the powerful pumping-engines were practically completed by Mr. E. George Mawbey, M.Inst.C.E. The 8-ft. diameter main outfall storm culvert four miles in length, designed by Mr. Mawbey, was shortly afterwards completed.

The Corporation were now in a position to reorganise their system of house refuse disposal. The filling up of pits had long been a source of anxiety to the Committee.

The disposal of pail excreta (the supply of which was constant) was interfered with by continued rain, frost, and snow, by harvesting operations, and the prohibition of surrounding local authorities.

Complaints were received as to the pails, although the receptacles were fitted with spring lids and properly washed with water, supplied through a hose at high pressure, before being replaced.

Other complaints were:—Disturbance of the inhabitants near the depôts; inconvenience to inhabitants by having to sit up to late hours to admit collectors; nuisance from depôts and from wagons passing along railways.

The competition of patent manures also interfered with the sale, and the difficulties generally were increasing year by year.

The pail system at its best is an expensive make shift one, and the only possible excuse for its adoption had been the absence of a proper system of sewers and adequate sewage disposal works, which had since been remedied.

The pail system is repulsive (especially in hot weather), liable to spread disease, and a constant heavy charge upon the rates.

The first step was to provide Destructors and, in order to test the feeling of the people, a plant of six of Manlove, Alliott & Co.'s cells was erected from Mr. Mawbey's designs. It was placed in the midst of a large population, within a mile of the centre of the town, and close to a large Board School, the stack being not more than twelve feet from the school boundary. This Station was paid for out of revenue.

There are moreover—

		Houses.		Population.
Within 100 yards radius	...	70	...	350
„ 200 „ „	...	340	...	1,700
„ 300 „ „	...	880	...	4,400
„ 400 „ „	...	1,880	...	9,400

Encouraged by the success of the first, two more six-cell works were erected shortly afterwards, at about the same distance from the centre of the town, followed by a fourth quite recently three quarters of a mile further away.

In pursuance of instructions the Borough Engineer reported in 1896 that the cost of collecting and disposing of the 10,320 tons of excreta from 6,395 pails was £3,000 or 9s. 5d. per closet per annum (nearly) for working expenses.

That the capital charge per closet per annum for conversion into water-closets would not be more than	7s. 4½d.
That the extra sewage resulting from the 6,395 water-closets would amount to about 61,000,000 gallons per annum, which could be pumped and treated at a cost of £550, equal to	1s. 9d. per closet.
	9s. 1¼d.
Deducting profit on water supply to water-closet (6s. a year) 10 per cent. on this	7d.
Total cost of W.C. during loan period ...	8s. 6¼d.;

Against 9s. 5d. by pail system.

The saving during the loan period would therefore be 11d. per closet and the ultimate saving, after the loan period, 7s. 3d. per closet.

A comparison of the pail system and water carriage works out as follows:—

PAIL SYSTEM.	WATER CARRIAGE.
Costs 1½d. in the £ on the rateable value of the whole Borough.	Costs ½d. in the £ on the whole Borough.
Cost per closet per year, collection and disposal ... ... 9s. 5d.	Cost per closet per year, pumping and treating ... ... 1s. 9d.
Cost per ton of excreta 6s. 0d.	Cost per ton of sewage, pumping and treating ... ⅜d. (·336)
Ditto, per 1,000 gallons 30s. 0d.	Ditto, per 1,000 gallons 1½d.
Owners do not pay for water, and absolute cost to ratepayers is as above.	Owners pay for water for w.c.'s, and profit on water say 7d. per closet per annum reduces the absolute working cost to 1s. 2d. per closet per annum, or one-third of 1d. in the £.
Against cost of 9s. 5d. per pail closet per annum.	Capital charge per closet per annum for conversion into w.c.'s 7s. 4¼d.
	Working expenses as above 1s. 2d.
	8s. 6¼d.

In the same year powers were granted to the Corporation under a provisional order to require owners to alter closets (other than w.c.'s) into water-closets, and also to require a separate moveable or other receptacle for ashes and house refuse. If such closets had been certified by the Medical Officer of Health as nuisances the alterations were to be carried out at the sole cost of the owners, although power was given to the Corporation to contribute towards the expenses.

Upon an owner failing to comply with a notice to convert, the Corporation were authorized to do the work and recover the cost.

Acting under the powers of the Order, 5,185 pails and 135 privies have at this date been converted into water-closets by the owners, at a cost to the Corporation of £13,012, equal to £2 9s. per closet.

The preliminary inspections and arrangements for contributions were made by the Medical Officer of Health and the Chief Inspector of Nuisances, and the whole of the drainage and structural work was examined from time to time by the Building Inspectors in the Borough Surveyor's Department.

So two of the chief items of town refuse are within measurable distance of satisfactory disposal.

We have now to consider the conditions of present-day Leicester, and the following figures may facilitate the process:—

Total area...	8,586 acres.
Built area...	about 2,200 acres.
Rateable value	£1,061,169
Population	220,000
Miles of streets	177
Houses	44,000
Water-closets	42,678
Pail-closets	593
Privies	68
Manure-pits	280
Ash-pits	2,049
Portable ash-bins	46,216
Private slaughterhouses	76
Public slaughterhouses	18
Cow-sheds	63

Death-rate from Medical Officer's Report (1902) 14·65.

House Refuse Collection is carried on in 177 miles of streets by the direct labour of Corporation workmen for the most part, a small district being scavenged by a contractor.

The great bulk of the refuse is tipped at the destructor stations, and eighty-four per cent. of it is collected from portable bins.

The men work in gangs of six with two horses and carts to each gang so that five men are always loading.

The carts have deep side boards and hold about two cubic yards.

Refuse both from ash-pits and bins is much lighter than heretofore, that from ash-pits weighing 47 lbs. per cubic foot, and that from bins 45 lbs. per cubic foot.

Each bin yields 13½ cwt. per annum (nearly) and the contents are collected once a week at least.

Each ash-pit yields 68 cwt. per annum, and the pits are emptied at

intervals of about eight or nine weeks. Refuse per head 9·7 cubic ft. or 3·92 cwts. per annum. Refuse per house 47·3 cubic feet, or 19·2 cwts. per annum, a reduction all round of 31 per cent. on the record for 1886.

The quality of the refuse has altogether changed since the introduction of the bins. It is drier, lighter, and in summer especially is little more than fine dust, paper and vegetable matter, and the usual domestic rubbish.

The very large proportion of persons working in factories, the facilities afforded by the Gas Department for the hire of gas stoves and for the supply of gas by slot meter has something to do with this reduction.

Another factor is, that portable bins are not calculated to hold an unlimited amount of vegetable refuse and rubbish, some of which has therefore to be burnt by householders.

The few pails remaining are scattered all over the town and the collection now finds employment for four men and six horses only.

The plant for the refuse collection is as follows:—

Plant.	*Men.*
65 carts.	24 ashpit emptiers.
47 railway wagons.	70 bin collectors.
4 slop carts.	7 night men.
1 tip wagon.	8 wharf men.
4 pail vans.	4 foremen.
1 pail cart.	4 old men (sorting refuse).
7 box wagons.	
3 canal boats.	

Total 117 men ... 47 horses.

The collection of house refuse is as shewn hereunder:—

	Tons.	
From ashpits ...	7,002	costing 2s. 6d. per ton for labour and horses only
Do. bins ...	33,141	do. 3s. to 3s. 6d. per ton.
Do. do. ... (Suburban).	2,997	do. 3s. 10d. per ton.
Trade Refuse...	1,562	do. 2. 6d. do.
Total ...	44,702	tons.

	Loads.
Manure	10,588
Night soil	1,092
Pail excreta	624

= 7,010 tons.

Grand total 51,712 tons.

The rubbish picked out of house refuse presents a curious medley, varying from a bath to a button or a perambulator to a penny whistle.

During the year ended the 7th November last, no less than 7,774 dozens of ginger beer bottles were sorted out and sold for £146 9s. 9d.

Certain men have a bonus of 50 per cent. of this amount and of other receipts for "sortings," which is distributed quarterly.

The dividends for the year averaged 8s. 2d. per man per quarter.

Bottle glass is sold at 10s. per ton.			
White do.	do.	20s. do.	
Sauce bottles	do.	2d. per doz.	
Medicine do.	do.	1½d. do.	
Jars	do.	3d. do.	
Wine bottles	do.	6d. do.	
Pickle do.	do.	3d. do.	
Champagne do.	do.	4d. do.	
Claret do.	do.	5d. do.	
Rags	do.	1s. 6d. per cwt.	
Bones	do.	2s. 6d. do.	
Light scrap iron	do.	15s. per ton.	
Galvanized scrap	do.	7s. do.	in trucks.
Detinned scrap	do.	3s. do.	do.

The total cost of collection, less receipts, amount to £12,846, which equals 1s. 2d. per head of population, or £72 12s. 0d. per mile of streets, as against 1s. 3·19d. per head and £112 17s. 0d. per mile in 1886.

Disposal. The great bulk of house refuse is cremated at the destructors, as shown hereafter; but some portion of it, such as the bottoms of wet ash-pits goes away with the manure.

During the year the sales were as follows:—

		£	s.	d.
7,080 tons manure by railway wagon	...	885	0	0
520 " " " canal boat	...	81	18	0
90 " pail excreta per box wagon	...	31	10	0
54 " " " " carts ...	...	5	0	0
3,072 loads trade refuse removed	...	384	0	0
Total ...		£1387	8	0

PARTICULARS OF THE FOUR DESTRUCTOR STATIONS.

	No. 1.	No. 2.	No. 3.	No. 4.
Area Site	2,030 S. yards.	1,800 S. yards.	4,200 S. yards.	5,727 S. yards.
Cost of Site	£1,776	£1,356	£3,150	£3,006
Cost of Buildings, Cells, Engine and Plant complete	£6,561	£6,529	£7,238	£11,969
Cost of Stack	£1,167	£1,540	£1,615	£1,461
Total Cost	£9,504	£9,425	£12,003	£16,436
Description of Stack	Octagonal in each case.			
Height of Stack	160 feet. Fire-brick lined up to 40 ft. high.	180 feet, lined throughout.	180 feet, lined throughout.	180 feet, lined throughout.
Batter	One in 35·433.			
Size of Flue	4′ 10½″ over sides.	5′ 6″	5′ 6″	5′ 6″
No. of Boilers	3, with Feed-heater in main flue.	1	1	3, with Green's Economiser.
Description of Boilers	11′ 0″ × 7′ 0″ Multitubular.	11′ 0″ × 7′ 0″ Multitubular.	11′ 0″ × 7′ 0″ Multitubular.	Water tube with 4″ tubes and 735 s. ft. heating surface in each. Wood & Brodie's System.
Description of Draught	Forced by Fan.	Natural.	Natural.	Forced by Fan.
Water Supply	Water Works.	Water Works and Well.	Water Works and Well.	Water Works and Well.
Other Plant	Horizontal Engine, Clinker Crusher. Screen. Mortar Mill.	Same as No. 1, with addition of Steam Disinfector.	Same as No. 1.	Same as No. 1, with Auxiliary Engine for Fan. Slab-making Plant.
Utilization of Steam	Driving above. Heating a Board School, Driving a large Engineering Works until recently.	Driving above, and for Disinfecting Apparatus.	Driving above.	Driving the whole of the above as well as Pumping and Heating Water for adjoining Baths.
No. of Cells and Design	6, Manlove, Alliott & Co.	6, Boro' Engineer's Design.	6, Boro' Engineer's Design.	6, Manlove, Alliott & Co., Wood & Brodie's System.
Furnace Bars	Biddle's Patent Rocking-bars in each case.			
Charging Accommodation	Open tip.	Open tip.	Open Tip.	Boulnois & Brodie's Charging Apparatus.

Stokers' Wages ... 4s. 8d. per 8 hour shift; 1s. per week extra for leading man in each shift when steam-raising on night shift.
Each man has a week's holiday in the year—wages paid.
No. of Stokers employed ... Varies from 4 to 6 at each works according to season.

The record of the Refuse destroyed, Wages paid, and Materials prepared for Sale during the year ending 29th October, 1903, is as follows:—

Destructor.	Quantity of Refuse Destroyed.									Wages Paid.			Mortar			Materials prepared for Sale.		
	Ash-pit and Bin Refuse.			Trade Refuse.			Meat and Fish.									Fine Ashes.	Rough Clinker.	Crushed Clinker.
	T.	*c.*	*q.*	*T.*	*c.*	*q.*	*T.*	*c.*	*q.*	£	*s.*	*d.*	*T.*	*c.*	*q.*	*Loads*	*Loads*	*Loads*
No. 1.—Nedham Street ...	10,585	5	3	194	2	3	20	0	1	656	7	4	266	0	3	553½	2,005½	523
No. 2.—Mill Lane	10,581	18	0	246	18	1	40	15	1	723	16	2	491	12	2	846¼	2,450¼	1,064
No. 3.—Lero	11,849	5	2	921	4	3	250	4	0	686	19	9	573	13	1	832¾	2,205	807½
No. 4.—West Humberstone	8,314	0	0	4	16	0	5	18	2	552	19	5	71	12	1	416½	1,515	395½
TOTALS FOR THE YEAR	41,330	9	1	1,367	1	3	316	18	0	2,620	2	8	1,402	18	3	2,649	8,175¾	2,790

The amounts received or chargeable for Steam or Prepared Materials, etc., during the same period are as shown hereunder:—

	Steam.			Mortar.			Fine Ashes.			Rough Clinker.			Crushed Clinker.			Bones, Iron, etc.			Burning Trade Refuse.			Total for Year.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Nedham Street..................	60	15	8	70	8	8	24	11	0	Free.			53	17	0	95	16	6	21	5	0	326	13	10
Mill Lane	...			123	18	5	34	19	0	5	6	0	84	16	6	95	4	8	27	5	6	371	10	1
Lero	...			155	16	4	41	12	9	Free.			64	2	0	79	7	6	92	11	8	433	10	3
West Humberstone...........	...			17	14	5	17	9	1	Free.			39	12	0	33	16	10	1	1	6	109	13	10
GRAND TOTALS	60	15	8	367	17	10	118	11	10	5	6	0	242	7	6	304	5	6	142	8	8	1,241	8	0

The average amount burnt per cell per day is about 6½ tons, and the cost of stokers' wages 8¾d. per ton.

The sales and charges, it will be noticed, recoup nearly 50 per cent. of the wages paid.

The total working expenses for the last financial year amounted to—

	s. d.	
	1 4·63	per ton destroyed.
and the capital charges to—	1 1·25	,, ,,
	2 5·88	per ton destroyed.

The residuals amount to 33⅛ per cent. of the weight of the refuse destroyed.

The calorific value of house refuse is becoming less year by year in Leicester from the causes already referred to.

A test of the power developed by the steam raising plant at Nedham Street with ordinary multitubular boilers gave the following result:—

Evaporation Test, Nedham Street Destructor, Forced Draught.

Length of trial, 9 a.m. to 6 p.m. (9 hours).

	1901.			
	January 31st	February 1st	February 3rd	February 4th
Amount of refuse burnt, in lbs.	47,656	50,232	52,808	48,300
Amount of water evaporated, in lbs.	23,200	22,800	43,500	44,300
Average boiler pressure, in lbs. per sq. inch	54·5	56·6	56	53·6
Temperature of feed water	102° F.	117° F.	102° F.	104·2° F.
Amount of water evaporated per lb. of refuse burnt	·48	·45	·82	·91
Do. do. do. from and at 212°	·55	·5	·93	1·03

The slab-making plant is by Musker, of Bootle, and it cost, with building complete, £1,800.

It has not been in operation long enough to enable a trustworthy opinion to be given as to the cost of working; but after making due allowances for repairs, etc., it appears as though 2½ in. slabs could be made and sold for something like 2s. 8d. to 3s. per square yard.

Street Cleansing should be done by strong able bodied men. The work is hard and trying to the constitution, the men having to be out in the worst weather.

The idea that decrepit old men are good enough for street sweeping is a thing of the past. Employment should be found for those who have grown old in the service of the municipality by all means, but certainly not in this direction.

Our street sweepers are for the most part men in the prime of life, and the majority are paid at the rate of 6d. an hour.

The town is divided into three main districts, viz. :—

	Miles.	Yards.	
The Central, containing	124	...	of roads and street.
The Northern (Suburban)	17	1,496	do.
The Southern do.	29	1,466	do.
Total mileage scavenged	171	1,202	

At the main depot in Jarvis Street there are the usual stables, horse boxes, cart sheds, and carpenters', wheelwrights', blacksmiths', and painters' shops, where all repairs are executed. A certain number of new vehicles, moreover, are built for the Street Cleansing, as well as for the Refuse Disposal Department.

The sweepers are divided into—

Five main road gangs of five sweepers and two horses and drivers to each gang.

Eight district gangs of three sweepers and one horse and driver to each gang.

A main road gang cleanse 4,500 lineal yards per day at a cost of 16s. 7d. per mile.

A district gang cleanse 4,600 lineal yards per day at a cost of 9s. 1d. per mile.

A water-cart is capable of spreading 7,480 gallons per day at a cost of 1s. 4d. per 1,000 gallons. A four-wheel water-van is capable of spreading 9,450 gallons per day at a cost of 1s. per 1,000 gallons.

Horse-machine brushes, costing 24s. 6d. a set, last on the average four weeks; ordinary hand-brushes nine to twelve days.

The following Table showing the details of Road and Street Cleansing may be of interest:—

Cleansing and Gravelling Roads and Streets and Cleaning out Gullies and Side Drains.

	Roads, &c., cleansed—Times per week.								Total.	No. of Gullies.	No. of Orderly Bins.	Tons Sweeping Removed.	Tons Horse Droppings from Bins.	Tons Gravel used.	No. of Sweepers engaged.	No. of Orderly Boys and Men.	No. of Horses.	Cost per Year Wages and Horse Hire.	Cost per Mile per Annum.	Cost per sq. yard per Annum.
	6	4	3	2	1	Once 10 days	Once 14 days	When required												
	miles	miles	miles	miles	miles	miles	miles	miles	miles									£	£	d.
**Central District* (Sanitary Committee)	10	2	14	5	93	...	...	...	124	6,900	33	31,200	1,250	470	50	13	20	7,496	60·9	1·12
Northern District (Suburban) Highway and Sewerage Committee.	...	...	...	3½	3	3½	8	...	18	968	...	2,500	...	30	7	...	2	702	39·34	·73
Southern District (Suburban) Highway and Sewerage Committee.	...	...	...	6	18¾	...	1	4	29¾	1,454	...	3,750	...	50	10	...	3	1,067	35·7	·66
	10	2	14	14½	114¾	3½	9	4	171¾	9,322	33	37,450	1,250	550	67	13	25	9,265	53·9 (average)	1d. per sq. yd. (average)

* The Cost of Street Watering varies from £500 to £700 a year according to the Season. * Sales of Sweepings, &c., realise about £200 a year.

PLANT FOR STREET CLEANSING, &c.			MEN EMPLOYED IN STREET CLEANSING, &c.		
CENTRAL.	NORTHERN.	SOUTHERN.	CENTRAL.	NORTHERN.	SOUTHERN.
19 Ordinary carts. 23 Slop carts. 23 Water carts & vans. 16 Horse sweeping machines. 7 Snow ploughs. 5 Horse scrapers. 7 Hand trucks.	2 Slop carts. 2 Horse sweeping machines. 2 Horse scrapers.	5 Slop carts. 2 Horse sweeping machines. 2 Horse scrapers.	22 Carters and horse-feeders. 71 Street sweepers, Court and Urinal cleaners, Orderly men and boys, and Yardmen. 2 Wheelwrights. 1 Blacksmith. 1 Railway wagon repairer. 1 Painter. 1 Carpenter. 4 Shop laborers.	7 Sweepers. 2 Carters.	10 Sweepers. 3 Carters.

Thoroughly satisfactory results cannot be obtained by hand or machine brushing only, owing to the smearing by the brushes and the subsequent evaporation of surface filth, and there can be no two opinions as to the sanitary advantages of cleansing by water.

In narrow paved streets especially, the inhabitants would not only be freed from the wretched "fuggy" smell arising from the pavements in hot weather; but the air and the pavement also would be cooled by the process.

This, medical officers of health will agree, would be of great benefit in crowded close districts subject to visitations of summer diarrhœa.

From a cleansing superintendent's point of view it is also, no doubt, the best system for granite, wood, and asphalt pavements. Not that there would be any saving in plant, because washing by water cannot be carried on in frosty weather, and is not advisable in periods of heavy rain. There may be a saving in men, horses, and wear and tear of plant in sweeping and picking up, the effects of washing being perceptible in the reduced yield of sweepings in subsequent cleansings.

Washing should be carried out with water supplied through a hose at high pressure, the pavements being swept before flushing, the sweepings picked up in as dry a state as possible, and the gullies emptied before and after flushing.

The Borough Engineer has, however, to look at the question from a broader point of view.

(1) *As to its effect upon street pavements.*—Asphalt, wood and granite pavements, properly grouted, would not suffer; but granite setts or randoms, racked up with gravel in the old-fashioned way, would certainly be affected injuriously by the removal of the racking up and consequent loosening of the pavement.

Hardwood pavements are the better for flushing, and their life would certainly be prolonged if the process were regularly applied.

(2) *As to Water Supply.*—In Leicester, for instance, there are, say, 95 miles of paved streets that might be cleansed by water applied at low pressure by water carts and vans. If the average frequency of thorough cleansing be taken at twice a week only, this would mean 85 million gallons of water a year, equal to an increase of 11,000 in the population.

With a separate system of mains for manufacturers and trade supplies, this objection would be of no moment; but in

the case of a town like Leicester, where water is about to be brought from the Derwent Valley, and many miles of paved streets are constructed annually, it is a question whether such a lavish use of water would be judicious.

(3) *Sewerage and Sewage Disposal.*—With proper gullies and an efficient system of sewer flushing one would not expect that the sewers would be affected detrimentally; but where the combined system of sewers is in use and sewage has to be pumped and treated, the increase in the quantity to be dealt with would be a consideration.

The construction of a combined machine sweeper and loader has exercised the inventive powers of local men; but, after many trials, it has not been found quite satisfactory. It swept and picked up dust and sludge, but the intermediate sticky compound was beyond its powers, and the strain on the machine caused frequent breakdowns. It has however elements of usefulness; as, for instance, in sweeping wood pavements before washing.

A word on machine sweeping. On granite pavements it may be employed at all times; but its use on macadamised roads in very dry or very wet weather has a disastrous effect upon the surface by the removal of the key or binding. This brings under notice the application of a compound for keeping down dust and for the binding of macadam roads. Tar-washing proves to be an expensive and not a very lasting method of dealing with the question.

Tar macadam is also an expensive formation, difficult to repair satisfactorily, and liable to rapid disintegration, if the materials are not of the very best and laid in good weather.

Westrumite appears to have some good properties in dust prevention and promises to be a useful adjunct in the making of macadamized roads. The Highway and Sewerage Committee of this Corporation are about to experiment upon a short length of road with this compound.

Snow removal has not been a large item of expenditure for some years, but when a fall does occur, the Highway men and horses join those of the Sanitary Committee in clearing the streets.

I fear that our method of disposing of street sweepings is rather a crude one, but owing to the absence of tips, snow, sludge, and, in the autumn, leaves from the 5,000 street trees, have to be deposited on waste or unused building land. Dry sweepings, some of the sludge, and horse droppings are taken to depôts and sold, when possible.

Generally.—Any lover of animals will regret the disappearance of the

horse from the public streets, but the introduction of electric traction and motor vehicles will greatly reduce the pollution of thoroughfares due to horse traction. There would also be less disintegration of pavements and macadam, and therefore much less sweepings and droppings to remove.

In the case of Leicester the electric tramway installation alone will have the effect of reducing the accumulation of manure to the extent of 2,000 tons per annum.

In 1897 certain powers were given to the Corporation by Act of Parliament to abolish private slaughter-houses upon paying compensation to owners, lessees and occupiers. The clearing out of these undesirable establishments will rid the town of a very large amount of foul matter, equivalent approximately to 900 tons per year.

If motor vehicles were adopted for highway work, refuse collection, street cleansing, etc., it would result in a further reduction of 500 tons per annum.

I may say that the Sanitary Committee have not lost sight of the question of motor vehicles, but with the short leads to the destructors, averaging only about three-quarters of a mile, perhaps, and taking into account the inevitable wear and tear occasioned by the frequent stopping and starting necessary in refuse collection and the picking up of sweepings, etc., they came to the conclusion, after due inquiry, that it would not be advisable to abolish the horsed vehicles at present.

THE MAYOR OF LEICESTER (Ald. A. E. Sawday) said that it gave him very great pleasure to welcome to Leicester the members of the Council of The Sanitary Institute and the other visitors present, and he extended this welcome with all the greater pleasure because he happened to be a member of a sister profession to theirs. In all matters which had to do with the well-being of the community, engineers and architects had a common interest, working side by side and hand in hand, and he hoped that in their several spheres they would do the best they could to raise the condition of the habitations of the people of this country. Leicester might be regarded, and had been so in late years, at all events, by sanitary engineers as a sort of happy hunting ground. Owing to various causes, they had been compelled in recent years to carry out very extensive works of a sanitary character, and in the conception, designing, and execution of those works they had been greatly assisted by the eminent engineers they had had in the persons of the late Mr. Gordon and in the present Borough Engineer and Surveyor, Mr. Mawbey, and by the very capable body of

assistants under their direction. He was glad that it was one of the oldest and most esteemed members of their engineering staff, Mr. Allen, who was to read a paper to them that morning on what in some towns was the very difficult and unsavoury question of the Collection, Disposal, and Utilization of Town Refuse. He ought also to refer to the great water scheme they had had in hand for many years, in which their Borough Waterworks Engineer, Mr. Griffith, had played a prominent part. The sanitary problems which had to be faced in this town had been very difficult ones with which to deal, for the site of Leicester was in a most unfavourable situation. Its position was very low, it rested on a stiff clay soil, the prevention of floods had presented great difficulties, and the provision of a satisfactory storm-water outfall had engaged serious attention for many years. Still, on the whole, they had solved these problems in what must be considered a fairly satisfactory manner. They had a large sewage farm and sewage disposal works which were answering their purpose very satisfactorily, whilst they had successfully solved the question of providing a storm-water outfall, and floods were a thing almost, indeed, he might say entirely, of the past. By its enterprise and willingness to carry out these necessary works at an enormous cost, Leicester had, he thought, set a very good example to other centres of industry. However, they probably knew a great deal more than he did about the work with which they had to deal, and his hope was that the result of their meeting would be very satisfactory from their own point of view and also from that of the public; for it was certain, that the greater the skill with which they brought about the reforms they desired to effect the better it would be for the people. He hoped, too, that their visit to Leicester would be a pleasurable one. The new parts of this town would, he felt sure, compare favourably with those of other large towns, and in the old portions of the borough they had archæological and architectural remains of an interesting description which were well worthy of their inspection. On behalf of the Town Council of Leicester, he begged to extend to them a very cordial welcome.

MR. E. GEORGE MAWBEY (Leicester) said he should like, in the first place, to propose a very hearty vote of thanks to his good friend the Assistant Borough Surveyor of Leicester for his very admirable paper. With regard to the sanitary work which had already been achieved in Leicester, it was a fact that during the last half century the death-rate had been reduced by as much as 10 per 1,000 per annum, and upon the present population of 220,000 that meant a saving of no fewer than 2,200 human lives a year. And it meant a great deal more; it meant the improved health and robustness of the people and a corresponding increase in their value as workers. He might also go so far as to say that the prosperity of that great town was due, to a large extent, to the increased good health and energy which had been brought about by the sanitary reforms that had been effected. Speaking of street sanitation, he submitted that the best conditions were secured by the adoption of impervious paving and the most per-

fect system of street watering, and by the most thorough sweeping and cleansing by water, that a town could afford. Whatever money was spent in those directions was well spent. On coming to Leicester, he found, as was the case in many other towns, large areas of badly paved streets, in the midst, unfortunately, as was usually the case, of thick populations, and there could be no doubt that deposits of impurities from the street surfaces, washed down into the imperfect joints and pervious bedding of these pavements, had been one of the causes of heavy epidemics of diarrhœa and other troubles. Conditions of that sort must be most conducive to the cultivation of anaërobic, if not pathogenic, germs of disease in those areas. It was noticeable that during the wet seasons, when the streets had been thoroughly washed by the downpours, the death-rate had been much lower. A good deal had been done in Leicester during the last twenty years or so in the right direction by the laying of about twenty miles of granite sett paving, grouted up with pitch and tar. They had also put down a considerable quantity of hard wood paving, instead of the soft, spongy wood of years gone by. The paving was mostly laid upon a bed of cement concrete, and that circumstance also was conducive to the improved health of the people. With respect to the principal subject dealt with in Mr. Allen's paper, they collected about 52,000 tons of house refuse a year, and of this quantity they burnt about 43,000 tons in the four destructors which had been erected. In order to avoid the carting of refuse through the streets from one portion of the borough to another, they adopted the plan of dividing the town into four districts, which had led to a great saving in cartage; on a great portion of the 43,000 tons of refuse burnt they effected a saving of at least one shilling a ton for carting, as they could readily realise when he informed them that the borough was five miles long and three miles wide. The question of providing a destructor cropped up as soon as he came to Leicester. In fact, the Chairman of the Sanitary Committee had already decided upon a site quite close to one of the Board Schools and an artisan population, and, moreover, he was determined that the cost of the land and destructor should be defrayed out of revenue in that instance. After the destructor had been at work for only one year, he said it was about time they had some more. So satisfactory had the results of the first one been that when they applied for a loan for the erection of two others, not a soul offered any opposition at the inquiry. They had now another destructor, and to the erection of that there was also no opposition. It was clear, from the experience they had gained there, that it was possible to build destructors in large centres of population without causing any nuisance, provided they were properly built and well managed. They did their best to utilise the waste heat from the destructors, but they must not expect too much in that direction. It was a mistake to do that, as anticipations might be falsified, for it was often found that, when obtained, a destructor did not produce as much steam as was expected from it. They were becoming particularly unfortunate in that respect in Leicester, for gas was in very general use for cooking purposes and for power in factories,

and consequently they did not get a very large proportion of such refuse as would produce the most heat. They had reduced their carting to an average of about three quarters of a mile, a factor which rendered the use of motor traction less necessary than was the case in some towns. With reference to the disposal of sewage, they had expended enormous sums of money in Leicester. Last year they pumped to the sewage farm—a distance of a mile and a half from the pumping station, and to a height of 170 feet, 2,756 million gallons of sewage, or about 12½ million tons, in the year. That meant that if the sewage had been allowed to accumulate in Leicester, it would have covered the inhabited area to the depth of five feet in one year. Just a few words about the manner in which they are dealing with the sewage. They had a sewage farm of 1,700 acres (1,400 acres available for sewage), but since they acquired that the borough has been extended, the population had increased by 50,000, and a great number of pail closets had been converted into water closets; consequently the requirements of the town had outgrown the capacity of the farm. The question arose, therefore, as to whether they should increase the area of the farm or adopt some other method of sewage treatment. What they did was to decide to increase the area of settling tanks and to provide twelve acres of bacteria beds. The sewage is pumped into detritus tanks, where there is some septic action, they did not want too much at that stage, then it would go into the twelve acres of bacteria beds, after which it would pass over the land for final purification. From experiments extending over fourteen months, they had found that that was the best system for Leicester, and that in practice on a large scale no better effluent could be produced than by this method. The effluent was equal to that obtained by the use of the detritus tanks and three contact beds, and was superior to that given by detritus tanks and two contact beds. The Local Government Board had passed the scheme, which he had prepared, embodying that system and involving an expenditure of £86,000, and also about £80,000 for additional new sewerage and pumping plant.

MR. ALDERMAN WINDLEY, J. P. (Leicester) said the theory of evolution had been demonstrated in Leicester in every department of sanitary work. During the last thirty years the Sanitary Committee had passed through almost every kind of experience and had tried nearly every kind of experiment in dealing with the refuse of the town. At the commencement of that period sanitary matters were in about as bad a condition as they could be. The sewers had been laid for about twenty years, and the cartoon they saw on the wall very fairly represented the state of many miles of sewers in that town. The brilliant idea which seemed to have occurred to the constructor of the sewers was that by omitting cement and mortar from the joints he could drain the soil above, neglecting to recognise the fact that what would let the water in would also let the sewage out. The consequence was that in storm times the sewage was forced into the sub-soil, and

they had suffered enormously from the foul sub-soil produced. Since that time they had introduced a main sewerage system, consisting of sewers some 8 feet in diameter, and laid in the most efficient manner, as illustrated by the cartoon exhibited. The ash-pit arrangements had gone through a similar process of evolution. It was at first suggested that the ash-pits should be drained, and orders were issued, but soon had to be stopped, as it was found that the drains rapidly filled up. Then it was decided that the ash-pits should be filled up to the ground level, but the water oozed out and this plan had also to be discontinued. Ash-pits of smaller dimensions were next ordered, but they also had been done away with in their turn. Those old abominations, privies and large cesspools, used to exist, mainly in the courts and alleys, and in many cases they were only a few feet from the doors of the cottages. The pail system having been brought to their notice by Dr. Clarke, a member of the Sanitary Committee, the Borough Surveyor, Mr. Stephens, reported upon the subject, with the result that they abolished privies and cesspools and introduced pails. This measure involved an enormous amount of work, and a very expensive plant for collection, sale, and transit by rail, etc. Eventually it was decided to abolish the pails and to substitute the water-closet system. The pails were an enormous improvement on the state of things previously existing, and the water supply was then so used up that it would have been very difficult to have brought water-closets into general use. Moreover, many people were careless in using water-closets, and where they were put in they had frequent applications from landlords to abolish them, and they were replaced by pails. Brushes, clothes, pieces of rag, and nearly everything you could mention were thrown into the pans, which were continually getting out of order. Since then they had obtained a better water supply and had been able to abolish the pails, or nearly the whole of them. He did not quite agree with Mr. Allen's conclusions as to the pails, for his opinion was that the earth system, if it could be adopted, would be the best, but in large towns that was impossible. Mr. Allen said that pails were not only expensive, but there was also a liability of contracting disease from their use. The same remark, however, applied to the water-closet system: it should not be imagined that when they pulled the chain they had got rid of the difficulty, for it was then that the risk of sickness began. In large towns where there was only a slight fall, the sewers became little better than elongated cesspools giving off sewer gas. Then they had to go to thousands of pounds of expense in pumping the sewage and getting rid of it. Mr. Mawbey, their Borough Engineer, had referred to the introduction of destructors, and to the action he took with regard to that question. They used to tip the ash refuse into old clay pits, but these got filled up, and the ever present difficulty was how to get rid of the ashes. No other method could be discovered that was comparable to the erection of a destructor, and it then became a question of cartage. He was anxious to find out whether a destructor had been erected near to dwelling houses, in any town, without becoming a nuisance, or danger, to health. With

that view, a deputation, of which he was a member, visited a large number of towns, and in London they saw a destructor which was entirely surrounded by buildings. It was on the strength of those investigations that he ventured to stake the reputation of the Sanitary Committee and the Town Council by the erection of a destructor near a Board School, and within a few yards of a number of respectable artisans' dwellings. While the plans were being got out, the owner of the houses begged them to desist, as, in his (the owner's) opinion, the erection of a destructor near his property would seriously depreciate its value, if not make it worthless. They endeavoured to re-assure him, and went on with the work. His fears proved entirely groundless, for the houses had never been empty from that day to this. He made these observations because he had had many questions put to him as to whether destructors could be erected close to dwellings without causing a nuisance. The early collection of house refuse was another improvement, but in his opinion there should be a daily collection if they were to have ideal sanitary conditions. As an improvement on the present weekly collection they might introduce a bi-weekly system, but in order to reach perfection the collection must be made daily. In addition, every street should be well paved, all cleansing operations should be carried out thoroughly, and he agreed with Mr. Mawbey as to the necessity of impervious paving.

COUNCILLOR A. SHAW (Leicester) said he was very pleased with the paper read by Mr. Allen, because it indicated that their attempts in the future would still be in a forward direction. It was a fact that the old pail system still had its friends and advocates. Indeed, he began to think their friend Mr. Alderman Windley was going to strongly advocate it that morning, but he did not really believe in it, they knew, but in the water-carriage system, and he had fought hard for the abolition of the 7,000 or 8,000 dirty pail closets which had been abolished in recent years. As to street watering, his conviction was that they would have to go further in that direction and also with regard to the cleansing of the streets. In former days they used to say—"Here is an old chap who has nowt to do, and if he had he couldn't do it," so they gave him a job as a road sweeper. Now they have men engaged in street cleansing who were full of strength and energy and possessed some intelligence as well. They wanted and would have men who knew the nature and importance of the work they had to do, and would accomplish it in an efficient and intelligent manner. He was glad that allusion had been made to the construction of the roads in the town, and he hoped the day would speedily arrive when macadamised roads would be absolutely things of the past. No matter how much they swept macadamised roads in wet weather, they would make sludge; no matter how they watered them in dry weather, they would make dust. It was with pleasure, therefore, that he heard it stated that experiments were to be made in Leicester with the object of obtaining roads of an improved character.

Dr. C. Killick Millard (Leicester) said he had listened to the excellent paper of Mr. Allen with very great interest. They must all agree that the various works included in the comprehensive title of that paper were of great benefit and utility to the community, but the question of their relative importance and value formed a point of some interest for their consideration. There were two distinct aspects of that subject of the collection and disposal of town refuse; first, from the point of view of the public convenience and the avoidance of public nuisance; second, from the purely sanitary standpoint. (1) Public convenience and the avoidance of nuisance was the aspect which was usually first forced upon the attention of public authorities, and from that point of view it was comparatively easy to decide the question of relative importance and to fix a standard of approximate perfection, as they had their eyes, ears, and noses, especially the last, to guide them, and if their own organs should fail them, those of other people quickly supplied the deficiency. To deal with that aspect of the question, it would be sufficient that ash-pits and dust bins were emptied before they got over-full; that the contents were removed and disposed of without causing nuisances in the way of unsightly accumulations and unpleasant smells; that drains and sewers did not smell or get choked up; and that roads did not get unduly muddy in winter or too dusty in summer. If there were any deficiences in any of these respects, they found that letters of complaint quickly revealed them. (2) But when they turned to the second point of view, the purely sanitary aspect, the problem was much more complex and they were beset by uncertainties. They all believed, he supposed, in the abstract, that the various measures comprehended under the term sanitation, including all those dealt with in Mr. Allen's paper, had a most important bearing on the health of a town. There in Leicester they certainly had good reason to believe it and to be satisfied with the results of the efforts which had been made during the last thirty years or so to improve the sanitation of the town. The general death-rate of the town had fallen most remarkably. During the five years ending December, 1872, the average yearly mortality was 26·8 per 1000 of the population, whilst thirty years later, during the five years ending 1902, it was only 16·7, a reduction of over 30 per cent., which was highly satisfactory, although some of that reduction must, no doubt, be attributed to altered age-incidence of the population and other causes. In 1901 the death-rate was 15·7; last year it was only 14·6; and in the present year he hoped it would be lower still.* The zymotic rate had decreased in an equally striking manner. There was very little typhoid fever, the deaths from that cause in the last four years having been only 28, 26, 20, and 12. As regards scarlet fever, there were only 11 deaths last year, and only 7 the year before, and that with a population of considerably over 200,000. With respect to small-pox, the number of deaths from this disease during the past thirty years had been so trifling as to cause the wonder of the whole

* The death-rate for 1903 was only 13·9—the lowest on record.

country. But when they came to ask the question: "What was the relative value of all the various sanitary works that had been carried out?" they found it very difficult to supply the answer. That was unfortunate, because it left them very much in the dark as to what their future actions should be. They wanted to make the sanitation of Leicester still better, and to further reduce the death-rate, but in what direction would the money be best spent? Should they spend more money on the improvement of their sewers? Should they collect the house refuse more frequently? Should they sweep their streets oftener and should they water them more frequently in summer? Their Borough Engineer had suggested, and he was inclined to agree with him, that one point which called for attention was improvement of the paving of their streets. The ordinary macadamised paving was unsuitable. Should they, therefore, have granite setts, which could be thoroughly cleansed by mere sweeping? To employ water for cleansing purposes was a better idea, but its adoption must prove rather expensive. To go in for a really improved system of paving would also be very expensive, but he believed the money would be well spent. Should they leave alone all the improvements already indicated and spend the money in making open spaces in the more crowded districts of the borough, where the old house property at present exists? The direction in which they should spend their money in future was a question upon which they required some light, or it was possible that the expenditure might not be productive of the very best results that could be attained.

DR. T. JOHNSTON (Rugby) said he thought he could say on behalf of the Sanitary Committee of the Rugby District Council that that opportunity of listening to such an instructive paper on the question of the disposal of house refuse had been a god-send to them. Rugby had been a sleepy old town, but it had just begun to wake up, and during the last two or three years the population had made a jump forward. They had been placed in a very great difficulty in relation to the subject of dealing with town refuse. The point which had been under much discussion recently, was whether they should have a refuse destructor or continue the old system of tips. They had a tip about a mile and a half from the town and in order to reach it had to traverse one of the worst roads imaginable. One reason why the road was so muddy was probably that some of the refuse got on to it, and they were constantly receiving complaints. He was pleased to say that the Sanitary Committee had decided to go in for a destructor, and it was with great interest that they had come here to learn the result of the process adopted in Leicester. The information they had received to-day was not only admirable, it was convincing, and he hoped that when they had seen the destructors they would be able to tell the Rugby Council that it had adopted the best means of getting rid of the refuse, and that it caused no unhealthy conditions in the surrounding localities.

Mr. H. J. Killford (Borough Surveyor, Ilkeston) said they hoped to erect a refuse destructor at Ilkeston within a very short time. Their town was a long straggling one, and he was glad to hear from Mr. Mawbey the value of splitting a town into districts, each with a destructor, so as to effect a saving in cartage.

Mr. H. A. Roechling (Leicester), after having complimented the author on the excellence of his paper, observed that the question of refuse destruction was a very important and at the same time a very interesting one. They had now a large number of empirical data obtained from careful observations and experiments, such as the quantity of refuse destroyed per cell in twenty-four hours, the evaporative power of refuse, &c.; but of the processes taking place during the destruction of the waste organic matters they knew but very little. It was very important, however, to have full light shed upon them, so that all the questions of a sanitary and economical nature that cropped up in each particular case could be fully and satisfactorily dealt with. He was glad to say very careful observations were now made abroad with a view to elucidating some of these obscure points. These experiments were being conducted with great skill, and he hoped they would lead before long to some definite results, which he might then be able to communicate to them. It was the duty of every one interested in matters of this kind to do his best to bring about further improvements both from a sanitary and economical point of view.

Mr. C. H. W. Biggs (London) said he should like to speak in support of Mr. Mawbey's observations, and to emphasise them. They had an object lesson in Leicester, where they were told something like ten lives per thousand per annum have been saved by the sanitary work which the Corporation have done in a certain number of years, whilst they also had it asserted as a fact that the general health of the community was better than it was before these reforms were effected. Now each human life had a money value, and each man in good health had a better money value than the man who was in poor health. It had been stated that sanitary work in Leicester had produced a certain return in reducing the death-rate and improving the health of the people, so the sole question was as to whether the return to be secured was equivalent to the amount of money expended. He thought it was. If the value of a life was taken at 20s. and they saved a life at the expense of 15s., they were 5s. in pocket. He maintained that they did not spend enough money in their large towns on sanitary work. He had given them a simple sum in arithmetic. It was worth thinking about and seeing if they could induce their councils to take more interest in sanitary work. It would be to the great advantage of every town.

Mr. A. H. Walker (Loughborough) said the erection of a new destructor had just been commenced at Loughborough. They had had one in operation since

1895, and from that time to the present all the refuse had been destroyed at the sewerage works. Sufficient steam had been generated by the destructor to pump all the sewage, with a lift of about twenty-four feet, on to the farm. At the beginning of last year so much refuse was collected that they were unable to cope with it by means of the existing plant, and his committee, after visiting several towns, came to the conclusion that the type of destructor adopted at West Humberstone, Leicester, was the best that could be erected. They started the work five weeks ago, and he would be glad to show the plant to any members of the Institute at any time.

THE CHAIRMAN (Mr. W. Whitaker, F.R.S.) said, with regard to the destruction of dust, he had been glad to hear the strong words used in favour of extending their municipal work in that direction. They knew by comparatively recent researches and by the experience of the late wet season that getting rid of dust had a great effect in reducing infantile mortality, and that was a matter which had always presented great difficulties to sanitarians. It was, moreover, a very serious question. In the streets of all large towns they saw children at play and breathing all the dust which was blowing about. They were living in an age of evolution. Last century was one in which the dominant idea was evolution, and a very good thing it was, for if they did not have evolution they would have revolution. They must have gradual progress to save violent spasmodic action. He knew that destructors had been scoffed at because they did not give certain results which some people had anticipated. But a destructor was not primarily a heat producing affair; it was a destroyer. The point to be gained was that it should do its work as a destroyer in an innocuous way in the centre of a town and close to the habitations of the people. The paper which had been read that day was one which should be carefully studied, especially by our younger members. It was a history of progress made in this large town, and was exactly the kind of testimony we wanted to circulate in the Journal of the Institute.

DISCUSSION ON

THE FLOODING OF BASEMENTS IN LONDON BY SEWAGE.

Opened by MAURICE FITZMAURICE, C.M.G., M.A., M.A.I., M.Inst.C.E.,
Engineer to the London County Council;

And Prof. H. R. KENWOOD, M.B., D.P.H., F.C.S. (FELLOW),
Medical Officer of Health, Stoke Newington.

At Sessional Meeting, Wednesday, December 9th, 1904.

MAURICE FITZMAURICE.

I MUST begin my remarks to-night by thanking the Council of this Institute for asking me to open this discussion. The subject which we are to consider is a very large one, namely the Flooding of Basements in London, and I can only consider that the selection of that subject is a way the Council has discovered for enabling us to consider the general question of metropolitan drainage. I speak of the drainage of London advisedly, because there are two kinds of drainage in London: there is the main drainage, which as you know is in the hands of the London County Council, and in speaking of that body I may say at once to-night, although I am Engineer to the Council, and know a good deal about the ins and outs of the drainage of London, I am speaking simply and solely as a private individual, and in no way as representing the London County Council. The London County Council deals with the main drainage of London, but the local drainage of London, a very important question also, is dealt with by the various local authorities, borough councils, and the Corporations of Westminster and the City of London, in their own areas. Both the local drainage and the main drainage dovetail into each other, and are absolutely inter-dependent. If on the one hand the London County Council sewers were not able to carry off the drainage from the local sewers, we should have floodings on both the local sewers

and on the London County Council sewers; if, on the other hand, the local sewers were not able to carry off the drainage while the County Council sewers were able to do so, there would be flooding on the local sewers only.

Unfortunately I, probably more than anyone in London at the present time, have a knowledge of the amount of flooding which has occurred during the last summer. In nearly every case of basement flooding the owner has written to the London County Council, and those letters have come to me. Many complaints have also been written to the Borough Councils, and the Borough Councils have sent on the letters to the London County Council, so that in most cases I have had two letters of complaint about every flooding in London. Some of them have been threatening, some of them have been resigned, and some are written more in sorrow than in anger; but they all naturally want compensation for having their basements flooded, due, as they say, to the London County Council sewers not being able to carry off the sewage. It might interest many people to know what has been done with these letters. A great number of people think no notice is taken of them: but this is what has actually been the case: a large map has been made of London, showing all the streets: from every letter of complaint the position of the house complained of is marked on that map and forms a definite record of flooding in each district. That map will be extremely useful in dealing with the flooding generally in London, because one can see at a glance where the trouble has been severe. In making this statement I hope I shall not be inundated with hundreds of thousands of letters asking to be placed on that map, because on certain parts of it we have got as many cases as we can put on. I have been able to judge from this map how very extensive the flooding of London has been during the last summer. Of course no one can deny that the flooding has been very great indeed. If we consider the north side of the river, the boroughs which have suffered to the greatest extent are Hammersmith, Kensington, and Hackney, and on the south side Wandsworth, Battersea, and Southwark. We can see that the flooding has been bad in a large number of streets, and in many cases has fallen on poor people who are unable to bear the extra expense of having their cellars and goods destroyed in this manner.

In dealing with these floods I divide them into two classes: we first have those floods which are due to the exceptional rainfall of the present year, where the premises have never been flooded before. The second class of floodings are those which have been flooded for several years in succession, and in some cases with increasing result year by year. Dealing with the first class, you must remember that the rain during the

last year has been absolutely unprecedented. The rainfall up to the present time exceeds in many parts of London forty inches for the year, and we have had in one day no less a quantity than three and a half inches of rain in London. We have had several days in which an inch of rain has fallen, and on twelve days during three months we have had more than half an inch of rain in London.

It is not in London alone that this great rainfall has occurred; it has been general all over the country. I daresay many of those present who have travelled on the Great Western Railway during the last few months have noticed that the Thames has spread into a lake for long lengths on either side of the river. There has been great flooding all along the line, but I have not found that anyone proposes, because of these floods, that there should be a secondary river on each side of the Thames all the way down from Oxford to the tidal water. But that would be just as reasonable a proposition as to suggest that we should deal with the floodings that have occurred in London through three inches of rain in a single day by special means: floodings which perhaps happen once in a hundred years. It is quite impossible and, in fact, too expensive to meet such emergencies, and beyond all reason to attempt to deal with floodings of that class; but the floodings of the second class are a totally different matter altogether. These, as I have said, have occurred in past years, and where the floodings increase. As the area in which the rain falls is built over and the rate of flow of rainfall into the sewers increases, so these floodings increase. I think it is only reasonable and right that measures should be taken to put an end to such floodings. At the same time in saying that I should like you to remember the powers the London County Council holds with regard to buildings on low-lying land. In such cases the London County Council has a right to say where houses are being built that no basement shall be connected with the sewers, and that the basements shall be made watertight. That prevents floodings in those districts. I think that is a thing which should be thought about, whether basements in other parts of London should not be dealt with more or less on the same principle. I am quite aware that with the basements in old houses it is almost impossible to do this, because if you cut off the basements from the sewers, you may in many cases have floodings through the floors because they are not watertight. But I think in all houses built in the future it would be only reasonable, as far as possible, that the basements of all houses should be cut off from the sewers. In the great majority of houses there is no necessity for a connection to be made between the basement and the sewer; and if the principle were laid down

that the basements shall not be connected with the sewer and the basement itself shall be made watertight, which is easily done by putting a layer of asphalt over the bottom and sides, at a small extra cost, I think that the floodings would not be so serious as they have been during the past year.

Before discussing the means of preventing flooding in basements, I will ask you for a few minutes to deal with the way in which the main drainage of London has grown up. Before the year 1855 all the drainage of London was delivered into streams which discharged directly into the Thames and, of course, the Thames was in a very polluted state. But that was not the only harm that was done. During high water it was quite impossible for these sewers to discharge into the Thames, and consequently for about twelve hours out of the twenty-four all the sewage backed up in these channels, snch as the Fleet Sewer, Counters Creek, and many others which had been old river channels, and in these the sewage lay stagnant for many hours. Sir Joseph Bazalgette was instructed by the Metropolitan Board of Works to deal with this question about the year 1855, or a little later, and he immediately did what was obviously the right thing to do, built intercepting sewers, which, instead of allowing any sewage to flow into the river, carried it out to Barking and Crossness respectively on the north and south sides of the Thames some few miles down the river. In this way the sewage was taken from that part of the river which goes through London to a spot where it can be discharged with comparatively little harm to the inhabitants. Sir Joseph also built a large number of main sewers, which are also under the control of the London County Council. I daresay it will be a revelation to a number of people to know the large number of sewers that are under the Council's care—the total length is somewhere about 300 miles. After all there is no difficulty in dealing with the *sewage* of London by itself, the difficulty comes in when we are dealing with the *storm water*. The main sewers of the sewerage system devised by Sir Joseph Bazalgette dealt easily with the sewage, but the storm water had still to be considered. What Sir Joseph Bazalgette did was this: When the intercepting sewers became full from storm water he had overflows which came into the old lines of the sewers which ran into the river, and he carried the storm water into the river instead of carrying it down to Barking and Crossness. Of course, then he met with exactly the same defect as was met with in the old sewers. During certain times of the tides these overflow storm sewers cannot deliver the water into the Thames, and therefore it has been necessary to build some pumping stations. These pumping stations

are situated on both north and south sides of the river, so that the storm water may be lifted at high tide into the river instead of allowing it to back up into the sewers.

One cannot help looking at this enormous scheme, which was carried out by Sir Joseph Bazalgette, without admiration at the way in which it has lasted, and at the satisfactory state of London during a long period. It is now fifty years since it has been completed, and I am sure Sir Joseph Bazalgette ought to have the credit for the great foresight which he used in the system he adopted, so that until about the year 1890 there was very little to complain about in the sewerage system of London. The population of London at the time Sir Joseph Bazalgette designed these works was about 2½ millions of people, but he looked forward to and provided for a sewerage system which would meet the needs of 3½ millions of people, or an extra million. He also designed the system at the same time to take a quarter of an inch of rain in 24 hours. The population of London now is closely approaching 5 millions, which is 1½ millions more than Sir Joseph Bazalgette designed this system for. We also know the rate at which the rainfall is coming into the sewers has increased. The area for which the rainfall was estimated has remained constant, but as the area has got built over, and the pervious soil has been replaced by houses and roads, the amount of rainfall that comes into the sewers has increased; in fact, the rain comes two or three times more rapidly into the sewers now than it did 20 or 30 years ago. We therefore come to this position: that we have to deal with the sewage of a population of 5 millions, and the sewers were only designed to deal with the sewerage of a population of 3½ millions, and we have also got to deal with the increased rainfall. I would, however, draw your attention very carefully to the fact that it is not a sewage difficulty in these sewers. In dry weather only about one-third of the volume of the sewers is used, whereas a heavy storm coming on may increase this volume by as much as five or six times.

Coming to the year 1889, when the London County Council took over the drainage of London among many other things, one of the first acts of the Council was to have a full investigation into the question of the main drainage of London. For that purpose they chose our Chairman to-night, Sir Benjamin Baker, and my predecessor as Engineer to the Council, Sir Alexander Binnie, to go fully into the question and report to the Council. That report was made to the Council in the year 1891, and the Council immediately gave orders that the necessary plans should be got out and the designs prepared according to what was proposed by Sir Benjamin Baker and Sir Alexander Binnie. Well, dealing with the question of the

sewage of London takes some time, and the preparation of the plans also takes time to be carried out, and it was not until the year 1895 that the London County Council were able to fully consider the plans for the scheme so recommended.

Now there was no difficulty in dealing with the amount of sewage; the difficulty was the rainfall, and many members of the London County Council thought at that time instead of making an enormous new system of main drainage, that it would be possible to deal with floods and storm water alone, and bring that water directly to the river. They therefore put off for some time the consideration of a large intercepting sewer on each side of the river, and they devoted themselves to dealing with the storm water and taking it away from the areas which were flooded. That policy was only partially successful.

There was another matter which was in the minds of members of the Council when they proposed not to make the main outfalls at that time. This was the time when the question of bacterial beds was cropping up, and this no doubt was in the minds of many members who, on the one hand, did not wish to do anything at the outfall works which would prevent them taking advantage of any system of filtration by bacterial beds, and, on the other hand, did not wish at that moment to settle upon any system of bacterial treatment which in the future might be proved to be not all it ought to be. Well, I think the Council were extremely wise in delaying the construction of works on the bacterial system at that time. I do not wish to say a word against that system, but I think it is right to say that even at the present time there are many people who are not sure what is the right system of bacterial treatment.

I had the honour last July of being asked to preside over the Engineering and Architectural Section of The Sanitary Institute Congress at Bradford, and heard many different views as regards the best system of bacterial treatment. It appears there are several systems which several people think the best. I have seen several works in operation in different parts of the kingdom, and I do not think we have got to finality on this question. I should be extremely sorry to see the London County Council at the present moment, much less in 1895, putting down any system of bacterial beds for London. From the remarks made last July on the bacterial system, it seems that the bacterial problem is a great deal more serious, and has a great many more sides to it than any other system which I can possibly imagine at the moment. It is to be hoped, however, that in a short time there will be some finality about this matter. I do not say this at all in any way as opposed to bacterial treatment; quite the reverse;

but I do want to be perfectly certain of what I am doing, and what the Council are doing before any treatment of that kind is adopted.

In the year 1895 the London County Council proposed to deal with the question of the provision of new sewers, and for this purpose they immediately set to work and carried out a great number of works, among which were many storm relief sewers and a new pumping station at Nine Elms Lane to deal with Battersea and Wandsworth sewers, and they also strengthened the pumping power in all their other stations. However, the result was not quite what was wished for, and I now come to the works which were placed before the London County Council by their Engineer in the year 1899, which works are now in progress. In dealing with these I have to say that the London County Council have to take a very much broader view of this question than appears to be right in particular districts of London. It is possible to relieve the floods in Islington, for instance, but what will happen? You increase the flooding in Hackney; while to relieve the floods in Wandsworth you increase the flooding in Lambeth. The London County Council have to consider the matter as a whole. They also have to consider the purity of the river. In 1899 they did consider all these things, and they decided that they would commence with new outfall sewers and new intercepting sewers, and gradually work westward. There was not the least good in starting the sewers at the west end of London if they had not the outfall for them at Barking and Crossness. The Council had also to consider the purity of the River Thames, and there are very few complaints about the Thames now. After the London County Council commenced to send the sludge out to the Barrow Deep, fifty miles below Barking, that took away a great deal of the impurities that were put into the Thames, and it was certainly not advisable to increase the impurity of the Thames by discharging the first rush of storm water, which might probably be only dilute sewage, into the Thames within the area of London. It is quite another matter when you have sewers which will carry off the first storm water and then discharge the rest into the Thames. If the first storm water is discharged directly into the Thames you will soon reduce the river to the position it was in before 1890. I am a very strong advocate of storm water being discharged into the Thames, but only when accompanied by such an increase in the capacity of the sewers as to leave ample room for the first flow of storm water, which is really worse than the sewage, to come down to the outfalls, and after that you can discharge what you like into the Thames, because it will be practically pure rain-water. The first flow of the water into the sewers mixes up the deposits in the sewers, and carries

with it the washing of the streets, and the first flow is therefore just as bad as any sewage which can possibly be put into the sewers, and it would be a monstrous thing to allow this water to go into the Thames. The London County Council spent large sums of money, and are spending a good deal, in sending sludge out to the Barrow Deep, practically out into the open sea, two and a half million tons of sludge every year; and if we allow the storm water, which is only very dilute sewage, to go into the Thames, it seems to me waste of money to send sludge out to sea.

Many people seem to think there is very little being done about the main outfall sewers, but I think this idea can only be due to ignorance. At the present time two new outfall sewers are being constructed from Barking to Abbey Mills, and these sewers are nine feet in diameter. They extend for four miles on the north side of the river. The contract for the next length of this outfall sewer to Old Ford is now under consideration by the Council, and will be let in a very short time. We have under that vote of 1899 constructed a new Hackney relief sewer, and we have extended the middle level sewer, and we have built a pumping station at Chelsea. On the south side the first sections of the outfall sewers, both high and low levels, have been completed. The contract for the next section of sewers, a contract of £295,000, was let last month, and work actually commenced on that contract yesterday. I do not think that anybody can expect improvements in the main drainage of London to be carried out in a moment. I should like to hear what our chairman to-night would have said, supposing the directors of the Forth Bridge had asked him to build that bridge in two instead of five years. I should like to know what he would have said if the Egyptian Government had asked him to build the Nile Reservoir Dams in two years instead of five. It would be just as reasonable to expect large works like those to be carried out in two years as it is to expect the main drainage of London to be carried out and completed in that time. The programme of 1899 involved the expenditure of £1,200,000, and it was definitely stated how much was to be spent in each year. Up to the end of 1903 the amount which was to be spent was £320,000, namely, in from 3½ to 4 years. What has actually been spent is £500,000, so that we have spent £180,000 more than the programme originally laid down by the Council. During the next two years we hope to spend at least another half a million on new sewers. All I can say is that that is a programme and rate of work which no one need be ashamed of. The London County Council since the year 1899, when they found that the storm-water reliefs did not relieve the districts, put their shoulders to the wheel, and they spent as

much as it was possible to spend on the main drainage of London. But before sitting down I should like to give a note of warning. You will probably have these new intercepting sewers coming up to the West End of London in three years' time, and perhaps they will come up before people are aware of it. All I can say is this, that you will be in a very bad state then if the local authorities do not take the bull by the horns, and find if their own local sewers are sufficient to discharge the rainfall into the new sewers now being constructed by the London County Council, doubling the capacity of the present sewers: because, if not, you will have flooding of the local sewers worse than you are having to-day from the main sewers.

Prof. H. R. Kenwood.

WHEN I undertook to contribute to this discussion, I did so under the impression that I could say a great deal with reference to the failure of the London County Council to deal with the most pressing sanitary need of the Metropolis, and as one whose district has suffered a great deal by reason of that default, I felt that I should much like an opportunity of saying it; but I have only quite recently ascertained that my ground for attack has been very much curtailed by the circumstance that the Council has recently been displaying considerable energy in carrying out some of the work which has been recommended by their skilled advisers as essential to be taken in hand for so many years. The information as to the progress of the work might and ought to have been better made known to the general public, having regard to the general and bitter complaints during the passing year of the negligence in this matter.

When an individual or a corporate body repents of its shortcomings and shows an earnest of doing its duty, that is not the time for one to find fault; it is the time rather for congratulations and encouragement; but the London County Council is an august body, which occupies the position of a supervising sanitary authority, and it is not often that one has an opportunity of finding fault with it (for it does much excellent work and it is advised by a very capable staff of officials) but I am not going to deny myself the luxury of indulging in some adverse criticism when the chance does occur; for, however much may be made of the London County Council's recent conversion, it must be conceded that the

dreadful and disgusting experiences of the present year would have been spared the inhabitants of London if the London County Council had not required ten years of complaints and memorials, several reports from their officers, a mandamus issued on the application of the Lee District Board, and a threat from at least one other direction to bring the Council's default before the courts of law, before it could make up its mind to act.

It is to the London County Council that we look for an example of enlightened and where necessary of prompt administration, and neither will be found in the record of their work dealing with the matter which we have under discussion this evening.

Gentlemen, what is the record?

Fourteen years ago the London County Council (who had then only been in existence for about eight months) instructed the Main Drainage Committee to secure the services of an eminent Civil Engineer to join the Engineer of the Council in a thorough examination of the whole sewerage system of the Metropolis.

About fourteen months afterwards Sir Benjamin Baker and Sir Alexander Binnie reported and recommended certain works, including new outfall sewers, at an estimated cost of over a million pounds.

About two months after that the London County Council adopted the Report and ordered detailed plans to be prepared, as the works "*were of so urgent a character that no delay should take place in carrying them out.*"

Nothing, however, was done for another four and a half years, when the Main Drainage Committee recommended that the works should be carried out. An Amendment was, however, carried in the following terms: "That the general enlargement of the main drainage system is not now necessary, but that local floodings need immediate attention."

About two years after this, in response to a deputation from the Metropolitan Sanitary Authorities, the Engineer to the London County Council was instructed to again report. This he did fifteen months afterwards, and in his Report he recommended work at an estimated cost of over one and a half millions.

Six months later a further Conference of the Parishes north of the Thames was held at Paddington, when the following resolution relating to the storm floodings and the attitude of the Council in the matter was passed: "That this Conference, comprising representatives of the leading Parishes on the north side of the Thames, hereby places on record its surprise that, notwithstanding the strong expression of opinion by the Main Drainage Committee of the London County Council and its responsible officers, and the repeated representations of Vestries and District

Boards to the effect that the existing accommodation of the metropolis was entirely inadequate to carry out the work required of it, no attempt should have been made to abate the intolerable nuisance complained of; and further, that this Conference urges upon the Council the absolute necessity of their at once carrying out such works as may be necessary to remedy the above-mentioned state of things."

In December, 1899, the London County Council, upon the report of the Main Drainage Committee, resolved to proceed with the construction of the two new main outfall sewers from Abbey Mills to Barking, and one between Deptford and Crossness, recommended by their advisers eight years previously, and pronounced by them at the time to be of "so urgent a character that no delay should take place in carrying it out." The resolution however was not carried without opposition, for Sir John McDougall moved, and Mr. Idris seconded, an amendment to the effect that "the general enlargement of the main drainage system is not now necessary, but that local floodings need immediate attention, and that therefore the recommendation be referred back to the Committee;" but the better sense of the Council as a body prevailed, and *part of the necessary work* recommended has been put in hand and is now, I am informed, more than half finished.

Those of us who are Metropolitan Medical Officers of Health feel very strongly with reference to this matter of the flooding of London basements with sewage from time to time, and while we must all fully recognise the excellent work which the County Council has done and is doing, we find it difficult to realise why what is undoubtedly the most pressing sanitary need of London was so long practically shelved. The fact that other more attractive schemes, schemes which perhaps appealed more to the general mass of their critics, were meanwhile dealt with, may in some measure explain their neglect, but it does not justify it.

Supposing that in one of the Metropolitan Boroughs the sanitary requirements of the people were so neglected by the local authority that numbers of the residents were compelled to live in dwellings at times flooded with sewage, and that the remedy lay with the sanitary authority, I am confident that the sanitary authority would at once recognise the gravity of the situation and deal with it *promptly* and at all costs; but if for argument we assume that the local authority were in default they would have the London County Council pressing for the necessary improvements. The defaulting authority in this matter has been the London County Council, and many of us who have at times been urged by that body to greater energy in prosecuting public health measures of

relatively little importance compared to the one under discussion this evening, have felt disposed to adopt the biblical rejoinder that they should first remove the beam which is in their own eye.

I for one would have preferred to have seen this great sanitary need of London given precedence over many improvement and re-housing schemes undertaken by the Council, which have furnished very modest results having regard to their costliness.

If it is not a matter of the first importance to keep sewage and sewage gases out of dwellings then I don't know what is. It is the first principle of all our sanitary teaching, and it is the greatest lesson of all our public health experience. The stringent by-laws of the London County Council are very largely designed to guard against this great danger, and the people have been educated to appreciate it.

The present Main Drainage System was constructed to serve a population of 3,450,000 with an average water supply of 31½ gallons per head, whereas it now serves 36 per cent. more persons with a water supply of from 35 to 40 gallons per head. Sir Joseph Bazalgette's scheme allowed for only ¼″ of rainfall in twenty-four hours, and it did not provide for the enormous increase in the population even within the metropolis, much less for taking in the drainage from the districts outside the metropolitan boundary of such parts as Acton, Willesden, Ealing, Tottenham, Wood Green, Hornsey, West Ham, and East Ham; neither was it contemplated to take any part of the sewage west of Chelsea. It is therefore obvious that as the sewers have become more and more filled up with dry-weather sewage, less space is left for rain-water, and that therefore the nuisance must increase year by year. The dry weather flow of sewage for which the system was designed was 108 million gallons daily, while it is now about 195 millions, or about 80 per cent. more.

The discharging capacity of the outfall sewers for the sewage north of the Thames as compared with the united discharging capacity of the high, middle, and low-level sewers which empty into them, is deficient to the extent of over 20,000 cubic feet of sewage per minute. Clearly the main sewerage provision ought to be at least of sufficient capacity to deal with the discharging power of the sewers that come into it, and it does not require an individual of the light and leading of a County Councillor to understand that there is no local remedy which can be effectually employed for dealing with the results of this state of things, and that the increased provision of both intercepting and main outfall sewerage is the essential step to take.

The failure of the London County Council to recognise this fact, and their culpable delay in giving effect to the recommendations of their advisers, not only endangered the health and comfort of their constituents, but it has occasioned and still occasions considerable alarm and difficulties to those whose duty it is to guard the public health of their sanitary areas.

The vital importance of guarding the soil and sub-soil from fæcal pollution is one of the greatest lessons that our sanitary experience has taught us, and the desire to benefit from that knowledge is responsible for the expenditure of millions of money in the direction of providing for the water-carriage system of sewage removal from houses, and for remedying defects in existing drains and sewers. Yet picture what was suffered to exist in London by the supervising sanitary authority. A state of things which not only leads to the flooding of dwellings with sewage, but also to a very large amount of avoidable pollution to the soil and subsoil.

In the North of London, as the result of this intolerable state of things, numerous complaints and applications for compensation reach the sanitary authorities. Washhouses, workrooms, living and sleeping rooms, underground bakehouses, and cellars are flooded from time to time with from an inch to a foot or two of sewage, and carpets, oilcloths, linoleums, mats, bedding, furniture, and stored goods are injured or spoilt. The flood-waters leave behind a coating of evil-smelling sewage-mud over and under the floors, thus seriously endangering the health of occupants of the dwellings, and necessitating much outlay for repairs and considerable distress among the poorer inhabitants. Compensation is often prayed for and sometimes demanded by the helpless victims. Landlords complain that in some cases it is necessary to keep the lower rooms empty, that tenants refuse to pay rent, and that tenants leave their houses. In one case a complaint was made that a fowl-house had been started upon a cruise and that nine fowls had been drowned. Sometimes it occurs to the sufferers to take the step of attempting to deduct his expenses from the rates, and here is an extract from a letter received less than a month ago by our Town Clerk: "Dear Sir, I herewith enclose cheque for the rates on above house, less £1 1s. 8d. I wrote to the Medical Officer of Health in June last, up to which time we had the overflow from the sewers out in the house three times. As no prompt measures were taken I took them myself, the only other course being to leave the house. The money was spent in having watertight boards put up back and front, with a set of blocks for the maids to get in and out; also for two heavy blocks of lead cast to fit the gullies and prevent the sewage from coming up like a fountain."

The default is almost Gilbertian in its bearings. The supervising

sanitary authority of the capital of the country, which is undoubtedly in the van of sanitation, demands under its by-laws the most stringent precautions against the possibility of the escape of drain gases in or about a dwelling, and by its neglect it suffers the dwelling to be flooded with sewage. The dweller, conscious of his peril, complains to the local authority, which is unable to deal with his complaint, and he then threatens to appeal to the London County Council, when he learns that the court of appeal is the offending authority.

It must not be thought that these floodings, consisting, as they so largely do, of surface water, are therefore comparatively harmless and inoffensive. No one who has had an intimate acquaintance with the matter which comes up from the sewers into basement rooms will be under that delusion; and, indeed, it is common knowledge that the storm waters issuing from the sewers in the earlier stages of a storm are almost, if not quite, as offensive as dry-weather sewage.

As the Main Drainage Committee of the London County Council point out, even the water flowing from the streets after heavy rainfall is as polluted as, and in some cases more so than, the actual flow in the sewers, and the flood discharges which now take place from the storm overflows are of an offensive character.

Another aspect of the question has reference to the River Thames. Every year that the existing state of things is suffered to continue leads to a considerable increase in the fouling of that river as it passes through London, by the existing overflow sewage. The Main Drainage Committee of the London County Council four years ago viewed with some apprehension the danger of the increasing pollution of the river, and they expressed the view that occasionally the effect on the foreshore was such as they could not contemplate with equanimity. I believe at the present time that the storm outlets into the Thames are brought into operation whenever the rainfall amounts to some one-sixth of an inch. The advantages gained by the expenditure of about £150,000 annually in the treatment and disposal of the sewage in London at the outfall works, with a view to freeing the Thames from pollution, must undoubtedly be largely neutralised if the river is not protected from gross contamination with sewage at points higher up.

The fact is the London County Council as a body have only comparatively recently appreciated to the full the great importance of this work, and they therefore did nothing to expedite it. Under great pressure from their officials, the Main Drainage Committee, local sanitary authorities, and the general public, they made a display of being desirous of doing

something by calling for successive reports at long intervals of time, and by taking a few feeble and halting steps. The fact also remains that even now, as I am informed on good engineering authority, they are not doing their utmost. The London County Council will not escape from justly severe criticism until they have taken hold of this work with both hands and have completed it, and until the general public, prompt to forgive and forget, have forgotten the disgraceful conditions under which so many of them were compelled to live for so many years.

Dr. S. Rideal (London) moved a vote of thanks to the authors of the papers. He said that the meeting was to be congratulated on having the subject put before them in such an able way by Mr. Fitzmaurice and by Dr. Kenwood. He had been particularly amused to find his old friend, Dr. Kenwood, who has always been regarded as being a most guarded and cautious individual, taking exception to the progressive work of the London County Council. He had brought home to them that evening the fact that the London County Council, which some of them had been admiring so much during the last few years for the great work which they had done to improve the sanitation of London, was after all open to criticism. It is as well to discuss these matters at the present time in order to stimulate our administrators to further action in the immediate future. It seemed to him that the works under construction will improve matters in London to a very considerable extent, and that after all the criticism which Dr. Kenwood had brought against the London County Council was only in respect of tardiness and delay rather than of defect and want of knowledge. He thought, however, there were one or two things in connection with this delay for which London would have to pay dearly. Some of the low-lying ground and unused land which still remains in the jurisdiction of the London County Council sewerage system, was being built on at the present time; and had been subjected to these floodings during recent years. They must realise that that land and other made land, land being raised for building purposes, must be infected with organisms which survive for a long time in such soil. These areas, when built upon, must therefore be regarded for a long time as insanitary areas, and the delay in remedying the floodings of London meant that this remaining available land for building purposes in London must be regarded by sanitary reformers with suspicion. As to remedial measures, so far as he could see, the way to prevent serious effects from these floodings is to adopt some method of disinfection after the floodings by polluted waters in basements. No local authority, and certainly not the London County Council, had ever dealt with the matter from that point of view, and it seemed to him they were running a very grave risk so long as the

floodings continued, in allowing the filmy and greasy slimy matters on the carpets, oil-cloths, etc., so ably described by Dr. Kenwood, to dry and finally be blown about in these basements. This was a very great risk, especially in the summer time. Fortunately, this last summer had been a cold summer, and we had not had following the floods a hot sun to dry up things very rapidly, so that people have had time to clean up and remedy the matter. If there had been a dry wind and a hot sun immediately after the floods, the filmy and greasy slime left by the floods would have dried to dust and been blown about by the wind and might have caused serious epidemics of disease. One other subject, which had not been discussed by Mr. Fitzmaurice, he had no doubt the London County Council were considering in connection with the important works now in progress, and that is dockising the Thames. If that great scheme ever comes about, it seemed to him, this problem of flooding would be aggravated. He had practical experience of the very unsavoury, dangerous, and poisonous character of the first flushings from the streets. Some years ago, he had occasion to examine samples taken from Victoria Street, Westminster, and of all the filthy fluids he had ever examined in his laboratory these liquids were the worst. Possibly motor cars and better street flushing would diminish the evil, together with different methods of road sanitation, with the oil treatment and so forth, and possibly a disinfecting remedy could be applied. But at the present time the street washings were most objectionable. Judging from the London County Council reports, these fluids from wood pavements are very objectionable to treat at the outfall works by bacterial methods because of the wood fibres and straw from the horse droppings choking the bacterial beds, unless a sedimentation or septic treatment is first resorted to. He did not like to say that, although some of these street washings go into the main sewers, this was a reason for a very considerable quantity going into the Thames; but he was quite certain some of it at present found its way into the basements of houses.

MR. W. KAYE PARRY (Dublin), in seconding the vote of thanks, said that what he had been anxious to hear had not been touched upon that evening, namely, the legal aspect of the matter. As a civil engineer practising in Ireland this matter had been brought home to him particularly, and since he had been in London he had come to the conclusion that the London citizens must be a very long-suffering community. If the same conditions had prevailed in Ireland he did not think they would have submitted so quietly as had been done in London. The sanitary authority for a small town in Ireland was recently brought before the Courts for flooding the basements of some houses, and an injunction was sought in the High Court to restrain them from doing injury to the property and creating dangers to the health of the inhabitants. This case was dismissed upon its merits, but he thought the lesson there taught was that there should be some enquiry as to the legal obligations of sanitary authorities in respect of such

floodings. It was a point worthy of consideration as to how far these authorities could be held liable for the injury which is undoubtedly caused by the floodings of basements.

Dr. W. Butler (Willesden) endorsed Dr. Kenwood's description of the subject as being the most pressing sanitary need of London. Every Medical Officer of Health in the neighbourhood of London who had had experience of the insanitary state of affairs produced by these continual floodings was aware of their serious character, and he, in his own district, could not recall a period when the conditions were more serious. He had seen beds floating about, walls knocked down, and 3 feet of sewage in occupied rooms. In bakehouses he had seen the flour bags standing three quarters high in sewage. In one case in which a public house was flooded it was found that they were actually drawing dilute sewage instead of beer. He was Medical Officer of a district which had not sent its complaints to Mr. Fitzmaurice, and it was a district a large part of which drains into the metropolitan sewers, though they were not represented on the London County Council. He could sympathise with Mr. Fitzmaurice because it was his misfortune to have to intercept these complaints. It was distinctly dispiriting to sanitary and health officers to find, directly a new drain was laid and completed to their satisfaction, that the owners of the house came and complained of flooding. The trouble was so grave in the case of underground bakehouses that he had to advise that no underground bakehouses subject to flooding should be certified in accordance with the new Act. This seemed rather hard when in all other respects they complied satisfactorily with the conditions of the Factory and Workshop Acts, and with the standard of the local authority. He had had to solve the problem locally, and this was an aspect of the question which had not been dealt with. He believed it possible in a district subject to flooding, where special circumstances demanded it, to prevent the flooding of underground dwellings. The system he had adopted was to reduce all drain openings to a minimum. Where there was a w.c. that was raised above the maximum flood level, iron drains were insisted on, and a ball valve gully substituted for the ordinary one. It was necessary to construct the manhole of exceptional strength, to have a screw-down cover, to insist that it shall be water-tight, and to anchor-bolt the manhole cover to the brickwork. The pressure to which the whole drainage system is subject is so great that nothing but strong work would stand against it. He believed where these conditions were complied with it was quite possible to prevent floodings of, at any rate, such a dangerous character as those these measures sought to remedy. Floods were rarely caused by a long continued, even severe, rain; it was the quick, heavy rainfall, which perhaps lasted only fifteen minutes, that most frequently caused floods. The sewers back up so rapidly in these circumstances that floodings occur, and very frequently after the rain has ceased. There was thus little objection under such conditions to having a ball valve gully because

they did not get what might be expected, flooding from the rainfall, but if owing to continuance of rainfall they did, it was certainly preferable to having floodings by sewage. He rather differed from Dr. Rideal's suggestion as to the use of disinfectants, because he did not see what value these could be in dealing with the conditions which flooding leaves behind it. There was not merely a silt left on the floors and walls, but in every crevice and nook beneath the flooring, and the use of disinfectants might induce a false sense of security without having removed the actual source of danger. With regard to the effect upon the public health, one portion of his district had been subject to floodings, and it was a fact that in that area the death rate was twice as high as it was for the rest of the district, though, of course, he could not say whether that was entirely due to the floodings, as many other circumstances might contribute to the higher mortality.

MR. C. H. COOPER (Wimbledon) said they ought to be much obliged to Mr. Fitzmaurice and Dr. Kenwood for the way in which they had opened the discussion. He must differ from Mr. Fitzmaurice on the point as to the rainfall this year being exceptional, so far as being liable to cause flooding was concerned. He had prepared a table showing the months since 1853 in which the rainfall in Wimbledon had exceeded five inches. In the year 1855, in the month of July there were 7·87 inches of rain, and in October, 1880, there were as much as 8·46 inches, whereas the greatest rainfall in any month of this year was in June, when there were 6·12 inches. Mr. Fitzmaurice was right in saying the total rainfall of this year had exceeded that of any previous year, of which we have a record, but the rainfall that leads to floods, namely the heavy rainfalls for a short period, has been just as great in other years as it has been in this. For this reason he did not think they ought to discontinue remedial works because of the alleged exceptional rainfall of the present year. The rainfall which had led to floodings was not as exceptional as people tried to make out. With regard to Dr. Butler's suggestion as to ball valve traps being relied upon to prevent flooding in cellars he altogether differed from that statement; such traps might last for a certain time, but sooner or later a storm would occur when there was something wrong and the flooding would occur as before. The floodings that had occurred this year he was afraid in very many cases were due to neglect. That certainly was the case in regard to most of the rivers throughout the country, and it was very much the case with regard to the Thames, which had been sadly neglected. The low-lying lands along this river and many of the islands had been raised, thereby reducing the area available for the flow of flood water. In the districts outside the metropolis there were powers to prevent houses being erected at low levels. He thought it was a great pity the London County Council did not acquire such powers, as at present the only power the London County Council had was to prevent houses being erected below high water mark. Wherever cellars could be prevented this should be done; he did not see why we should go

back to prehistoric times and live underground, as too many people did in the towns to-day. With regard to the London sewer overflows, he did not think Dr. Kenwood was right in saying that the storm overflows discharged at one-eighth inch of rainfall. According to the late Mr. Santo Crimp, M.Inst. C.E., the London overflows only took three per cent. of the total amount discharged by the sewers. If that was so, one-eighth of an inch could not possibly set the storm overflows going. It always occurred to him it was a great pity that the London County Council did not make more use of the overflows than it does. Mr. Fitzmaurice was quite right in saying the high tide affects these overflows, but there were a number of the higher districts where the old river beds might still be used with very great advantage. It seemed ridiculous to him to go on spending money in taking the storm water right down to Crossness and Barking when it might be discharged into the rivers close by. It was true the first street washings were very offensive, but after the first discharge a great part of the water could very well be sent into the river. He had known the Thames for many years, and could remember during the eighties when the mud banks were in a far worse state than they are to-day.

Mr. Francis A. Dod (Stoke Newington) said he had been most interested in the speeches which had been delivered, and could not help feeling that the London County Council was responsible for the present state of affairs. He submitted that they were the chief sanitary authority of London, and as such their first thought should be for the health of the inhabitants. A report had been made by Sir Benjamin Baker and Sir Alexander Binnie, but Mr. Fitzmaurice had not told the meeting what that report was. They could well imagine what it was by the resolution of the London County Council on the 14th April, 1891, when they adopted it and gave instructions that detailed plans should be prepared, and the works being of so urgent a character that no delay should be made in carrying them out. Under these circumstances he would ask the Chairman to allow him to move the following resolution: "This meeting is of opinion that the flooding of London basements with sewage is a grave menace to public health, and regrets this menace has been allowed to continue for so many years, and requests the Council of the Institute to urge the London County Council to proceed with all possible expedition to the completion of the necessary works upon the main sewers, and so relieve London from its present insanitary state."

Mr. W. F. Loveday (Stoke Newington) said he was very interested to know what the London County Council were doing. It seemed to him that Mr. Fitzmaurice had a very thankless task to perform that evening in excusing the misdeeds and sins of omission on the part of the London County Council in years gone by. He had hoped to have heard what the capacity of the sewers was at the present time, and what they were at the time the London County Council

came into existence, and he would also like to have known if the London County Council had done anything since they had been in existence to mitigate this evil of flooding. Judging from what Mr. Fitzmaurice and Dr. Kenwood had said, the London County Council had apparently done nothing to increase the capacity of the sewers and yet as far back as 1891 two eminent experts reported to the Council and showed that the outfall was 3,300 cubic feet per minute deficient. Reference had been made to the excellent work of Sir Joseph Bazalgette who had designed this system for a population of 3½ millions. The London County Council were perfectly well aware of that, and not only so, but that the outside districts of Acton, Willesden, Tottenham, Wood Green, Hornsey, East and West Ham, participated in the metropolitan main drainage system. All these districts had their sewage put into the metropolitan sewers, and thus the sewers of London had had something like 80 per cent. of dry sewage flowing beyond what was expected by Sir Joseph Bazalgette. The London County Council must have been aware of this, and it seemed to him also that consequently they were to blame for having allowed so many years to have gone by without having sought a remedy. London ought to be grateful, at any rate, that the Council now attempted to grapple with the subject, and the only thing to be done was to see that the central authority was kept up to the mark, and not be allowed to lag behind after the excitement of this year's record rainfall had passed away. He seconded the proposition of Mr. Dod with very great pleasure, and hoped that it would be sent on to the London County Council showing that The Sanitary Institute have not been remiss with regard to the matter by keeping a watchful eye on them as well as on the London Boroughs for the benefit of the inhabitants.

MR. J. S. HODGSON (London) observed there was one point not referred to by Mr. Cooper in connection with his contention as to the rainfall of the present year not being so exceptional as was thought. It must be borne in mind that the amount of impervious surface in the metropolitan area had largely increased, so that the actual effects of the present year's rainfall might be exceptional, so far as the main drainage system was concerned, even on the basis of Mr. Cooper's comparison. All his experience led him to agree with Mr. Cooper that a large amount of the rainfall of London might be reasonably discharged into the Thames, on both sides of the river. It appeared to be the general opinion that a separate system for London was an impossibility, a view maintained by all who had been officially connected with the subject. American experience was, however, in favour of a separate system. In Boston a combined system on the same basis as that for London had been put down, but since the construction of the city's main drainage works, steps had been taken to put the system on an absolutely rigid separate basis, and within the next ten years there will not be a combined system in Boston.

The Chairman (Sir Benjamin Baker, K.C.M.G., F.R.S.) said it would be his duty to put the vote of thanks to the meeting before dealing with the resolution proposed by Mr. Dod, and he was quite sure that whatever difference there might exist in the meeting as to the opinions raised, they would be united in the vote of thanks. Mr. Fitzmaurice had not been long in office, but he had been personally known to him (the Chairman) for many years. In fact, from the time Mr. Fitzmaurice had left College they had been friends, and he could assure the meeting that if energy could do that which the meeting wanted, then they had the right man in the right place in Mr. Fitzmaurice. To some extent the views on the part of the meeting in the resolution urging attention upon the London County Council had rather been discounted by Mr. Fitzmaurice in his opening remarks as to what the Council were doing. But he quite agreed that it was useless thrashing a dead horse and regretting the delay which had occurred since the date of his report, and the London County Council had so many irons in the fire and so many different interests were pressing upon it that he quite understood why the more costly of the recommendations in the joint report of Sir Alexander Binnie and himself were delayed in the first instance. Those recommendations involved very large expenditure on the part of the ratepayers, and if by dealing locally with the floodings the evil could have been remedied, that policy would have been a popular alternative to the electors of London. Events had shown, however, that with the greater population and the increased floodings caused by water running off pavements and roofs and other consequent developments of a great city, that the large measures which were then recommended must now be carried out. While, as he said, it was no good thrashing a dead horse, he had not the least objection to giving a touch of the spur to a live one. Mr. Fitzmaurice had told them he was going on with the work as rapidly as possible, and he did not think it would do the least harm to the London County Council if there was a little pressure put on by The Sanitary Institute to urge them to go a little faster than they contemplated. If that was so he was sure Mr. Fitzmaurice would be the last one to regret it. He quite understood that the resolution proposed was not intended in any hostile spirit to the London County Council or other officials, because it must be admitted that it is an intolerable trial and nuisance to have sewage in basements, and a little plain speaking must be expected. It was quite unnecessary to enlarge upon a point like that, because the nuisance was obviously intolerable to those who had suffered from it. He was sure they might accept Mr. Fitzmaurice's assurance that this fact was now fully realised by the London County Council, and that every possible effort, whether the resolution was passed or not, would be made by the Council to remedy the matter as soon as possible.

Mr. Fitzmaurice, in acknowledgment, said he did not know there was very much to reply to. He was glad to find that the complaints against the London County Council had boiled down to the fact that their main drainage work was

not sufficiently advertised. There were only two points which might be referred to, one which had been already pointed out with regard to the rainfall of 1855, when the population of London was 2½ millions, whereas now it was nearly 5 millions. They had increased the number of streets and many buildings had been completed since that time, which enabled the rainfall to run off the ground 3 times as quickly as in 1855, so that it was quite ridiculous to compare one year with the other. The other matter was not a matter spoken about at all and hardly a matter for discussion there, but probably some members might help him in a very difficult matter, that was, not the entrance of sewage water into sewers, but the exit of gas from the sewers. Considerable complaints were made as to the smells which came up from the ventilators on the surface of the streets, and no doubt it was most objectionable. At the same time, they must remember there was a large army of men at work in these sewers under the streets of London, and unless there was some means of ventilation for these sewers it would be impossible for them to do the work. In some cases he had asked the Borough Councils to allow him to put up ventilating shafts, perhaps a ventilator of 12 in. in diameter, in order to remedy the smells in the streets. In many cases permission had been refused, and he could only say as far as he was concerned he would decline to advise the London County Council to close any ventilation opening on the surface of the streets unless he could get another to take its place. He was responsible to the Council for the lives of a large number of men: only the other day he had two men pulled out of the sewers senseless from the gas which had developed there. Several times during the last few years they had had the men badly burnt through explosions of gas in the sewers coming from different works, such as petroleum works and so forth. These men must have lanterns and explosions had occurred in that way. If those present would try to help him in the ventilation of the sewers and get the authorities to allow and give sites for ventilating columns so as to avoid this unpleasant gas coming up to the road surface, they would do something to preserve the lives and health of a large number of men who worked underground in the sewers.

DR. H. R. KENWOOD (London) thanked the meeting for the vote of thanks which had been passed, and said he hoped he had made it quite clear that so far as the officers of the Council were concerned, and so far as the Main Drainage Committee of the Council were concerned, he thought their record was beyond reproach. What he found fault with was that the London County Council as a body should have delayed taking action in respect of such a pressing matter. Mr. Fitzmaurice had given a most interesting account of the work, but he thought the meeting would agree that Mr. Fitzmaurice had not said anything which excused the London County Council for their neglect and default for a period of ten long years after they had received a valuable report from their experts, and had themselves expressed the view that the work was "urgently

necessary." On that account he hoped the resolution proposed and seconded would be passed. London had reached the limit of its suffering and inconvenience in this matter, and the resolution coming from The Sanitary Institute, if approved by the Council of the Institute, would have weight, and possibly some effect in still further pressing on the work. No doubt the London County Council, during the last two or three years, had been doing a great deal towards remedying the evil. On the other hand, nothing would be lost by passing the resolution that evening, and it would probably do good in reminding the Council that London is earnest in this matter, and expects them to take hold of the work with both hands.

The Chairman said that, in accordance with the rules of the Institute, the resolution passed at a sessional meeting would have to be submitted to the Council to be dealt with as they might deem necessary, and he would therefore read the resolution: "That this meeting is of opinion that the floodings of London basements with sewage is a grave menace to public health, and regrets this menace has been allowed to continue for so many years, and requests the Council of the Institute to urge upon the London County Council to proceed with all possible expedition with the completion of the necessary works upon the main sewers, and so relieve London from its present insanitary state."

Note.—Resolutions passed at meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council on the resolutions are given at p. 153.

DISCUSSION ON

THE VENTILATION OF BUILDINGS

(Including Public Halls and Churches, Theatres, Factories, Hospitals, and Schools).

Opened by EDWIN T. HALL, F.R.I.B.A. (FELLOW AND MEMBER OF COUNCIL),

At a Provincial Sessional Meeting at Manchester, January 29th, 1904.

FIRST of all I think it is of very great importance that we should clearly define what we understand by the word "ventilation." It is, as I understand it, the passing through a room fresh air, without draughts, in such volume and at such temperature as may be necessary for the sanitary comfort of the occupants. I have laid stress upon the word "through" (passing through the room) because we can get no true ventilation by merely admitting air into a building unless we supply the necessary exits for it. That has been demonstrated again and again, but one very simple illustration of it is in connection with tests as to the porosity of walls. An external wall of brick or of stone is not an air-tight barrier, but merely a very slow filter. Professor Pettenkofer was, I think, the first who drew attention to this, but quite recently there was a very good illustration of the fact in this way: In a room with all the inlets and outlets sealed, candles were burned, and by the quantity of carbonic acid which they evolved chemists were able to ascertain the amount of fresh air that came in. It was found that under those conditions the volume of air contained in the room was renewed, that is to say replaced by fresh air, in periods, according to the wind, of from about an hour and three quarters to a little over three hours. But the moment the register in the fireplace was opened the air came in at double that velocity, in other words the air in the room was renewed in less than an hour; and when a fire was lighted, with no other inlets but through the wall, it was renewed in the fifth part of an hour. That shows the necessity and the great benefit to us of having through currents of air and not merely inlets. Now another general observation I should like to make is this, that no one system of ventilation is applicable to all types of building,

nor to all purposes for which any one type of building is used. Again, I should like to remark (of course it is known to you, but for the sake of making clear what I may say later on I should lay stress upon it) that the air is practically one ocean. No matter whether it be in the country or whether it be in a city like Manchester, it is the same air, and it is astonishing how little it differs in purity. For example, in the country, in Scotland, numerous tests showed that practically the amount of carbonic acid (CO_2) which was in the atmosphere was about three volumes per 10,000, whereas in London it was only 3·5, and in most of the large cities in England it did not exceed about 4. Of course I am not speaking of abnormal conditions, but of the normal atmospheric condition of the cities. That being so, we may assume that wherever we are we have practically pure and free air, an ocean from which to draw for the purposes we require. A fallacy that it is just as well to mention, because we were all taught it many years ago, is that owing to the great specific gravity of carbonic acid it falls to the ground, and therefore at a given height above there is less impurity, less danger to breathing, than if we are lower down. Well, that has been conclusively proved not to be the case in rooms of moderate altitude. Probably this would not apply in such a building as a church, but only to the rooms in which we are ordinarily assembled. A great many tests have been made, and it has been shown that the CO_2 at a foot above the floor is practically the same as the CO_2 at a foot below the ceiling, and in the intermediate space too. Then another point is velocity. We cannot let cold or warm air come in at a great velocity without discomfort, and I think that for practical purposes it is not desirable that air should come in at a greater rate than three to four feet per second. My last general observation is that we should have no unventilated space in a room. In other words it is as necessary to scour the corners of a room as it is to scour the centre of a room, and that may be done either by artificial or by what is usually called natural ventilation.

Having made these general remarks, I will turn to the first and simplest type of building of which I have to speak. This is the ordinary house. Now, we must be practical people, and we do not want to introduce into a house great and expensive systems of ventilation when we can normally do without them. The things, therefore, to remember are:—

1st. That in rooms we should keep the top of our windows close up to the ceiling, and not leave a big space above them. If the windows were kept down two or three feet we should not get the scour which we require;

2nd. It is not desirable in any room where there is a fireplace with a

fire going that cold air should come in at the floor level; because naturally the fire is a very strong aspirating influence, and it would draw the cold air straight to it and everyone's feet would be cold;

3rd. Sometimes, owing to gales of wind and other causes, it is not always pleasant to open a window in a room, and then we want some kind of tube to let in the air. The ordinary Tobin tube is, as we are aware, a tube which generally runs up inside a room (an unsightly thing) and it draws its air, if the room is on the ground floor, from close to the ground. Manifestly, therefore, it is drawing its air from a polluted source, in that the ground air which is given off contains a good deal of CO_2. My own practice has always been to build an L-shaped tube into the outer wall, starting from about six feet from the floor, bringing the inner arm up about eighteen inches, with a sloped roof, and a vertical sheet of gauze at the upper part, with a little door at the bottom for cleaning out the tube. The gauze is beneficial because if cold air is cut up into very fine spray there is not that draught which we have if it enters in a dense current. The best of all ventilating apparatus for aspirating is an open fire, but it is desirable to have some other form of outlet into a separate flue alongside a warm flue, making the outlet close to the ceiling, so that the heated air may pass away. I should also remark that an essential thing for the comfort of a house is to have the hall and staircase warmed. This may be done either by an open fire, which is excellent, or it may be done by hot-water radiators. It should not be done with an iron stove with a fire in it, because, if the wind is very strong, aspirating the air through the flue makes the stove red-hot, and I think chemists will tell you that you would then get carbon oxide into the air, and that is a very deadly poison indeed.

Now, passing from the ordinary house, I will just give a glance at houses of a larger size, such as Homes which are provided for nursing institutes, and other buildings of this sort. It is manifest that when you have a building containing, as in the case of some of the institutions to which I am architect, 200 or 300 bedrooms, it is a great cost to have fireplaces in each room; it involves a great deal of labour in carrying up fuel, and further there is a great deal of dust generated. Therefore, I think in such rooms a very good system is to heat them by hot-water pipes, with perhaps a radiator in the room (it depends upon its size) to have fresh air laid on to the radiator, and to have an aspirating flue near the ceiling going into a big duct which eventually ends in a shaft at the roof, and in that an electric fan. By this means we insure a current of air through the room, which is sufficiently warm to be comfortable; the heating is inexpensive, and you save that pollution of the

atmosphere which 200 fires of ordinary coal would cause. All our efforts as sanitarians should be given to minimise the throwing of soot into the atmosphere of towns.

Passing from Homes and coming to Public Halls and Churches, we have a very different set of circumstances from those of the homes and private houses which we have been considering. In the first place, we have to deal with a crowd of people. These are at rest (I am afraid sometimes in repose) but, at all events, they give off in such conditions much less carbonic acid than they would if they were actively employed, as in workshops; and therefore we must differentiate between a lot of people in an assembly and a lot of people at work in a factory. But each person in a big room is a furnace giving off heat and, further, giving off capillary and respiratory emanations. I will not weary you with a lot of figures, but I believe chemists tell you that a thousand people give off, among other things, the equivalent of eight gallons of water in aqueous vapour in the course of an hour; and, further, that the breath which these respire gives off a greater percentage (I think it is about 3½ per cent. greater) of CO_2 than that which is contained in the ordinary atmosphere. Then they take up so much oxygen. So that as a matter of fact they are technically fouling the atmosphere. We have generally in such buildings (I am not speaking of a hall scientifically built, like the one in which we are gathered, but in such buildings as we see all round the country) we have very frequently shaft ventilators in the roof, but no means for the inlet of fresh air except the windows; and it is manifest that people sitting closely packed together, cannot have a window open pouring cold air down upon them. Well, with these aspirating flues, these shafts in the roof, the wind pulling on them, as it does pull sometimes, so attenuates the atmosphere, which is, of course, elastic, that if the audience is standing up and suddenly sits down, the action is that of a piston, and down comes a big draught. Moreover, if we have two or three of these shafts one will act as an inlet and another as an outlet, and so we get not only draughts but alternations of heat and cold. One very frequently sees furnace chambers for heating air in the basement, with gratings above in the floor of a hall. These grating-inlets are very nice if one sits close to them, but the hot air simply rises to the top of the building in practically a vertical column, and the people who are sitting a few yards away have no benefit whatever from it. Then we have sometimes steam heating. Personally, I think steam heating is very objectionable, either by pipes or by radiators. You cannot get a steam radiator to a less temperature than something like 215 to 220, but if you use hot-

water radiators you can maintain these at a temperature of 150 or 160, and air so warmed has not that burnt or dry taste which you find from steam radiators. The difficulty arising from the drying of the air by the steam radiators is very often met by placing bowls of water on them. This is a very crude and unscientific way of remedying an evil. I remember some time ago going over a large institution at Munich with the medical chief, who told me they had to be always putting cold water vessels on their steam radiators, because the air was so dry that it was unpleasant to breathe.

I have already mentioned the evil of stoves. Stoves give a certain amount of heat locally but the danger from the carbon oxide is present. Another thing I would ask you most carefully to avoid is having floor channels with any system of pipes. Sunken floor channels always become receptacles for dust. The men in cleaning the room cannot help but brush into them, and gradually they became very foul indeed. It is all very well to say they may be cleaned, practically it is almost impossible to clean them if there are many pipes in them. If you must have air-inlets at the floor in such a place as the centre of a church, you can put under the seats raised platforms, with vertical risers, fitted with iron gratings perforated to suit the proximity to or distance from the source of heat. By that means you get the air delivered in a pleasant way at the floor level without the danger to which I have just alluded. As a rule I think a church may be admirably heated by having hot-water pipes around it with radiators placed underneath the aisle windows, in cases closed except at the top, the fresh air entering the case from the back, passing through and over the radiator and entering warmed into the building from the top. The warm air coming up meets and warms the cold air from the window or prevents the chilling of the air, which results in a down draught. But you often find great cold coming from the clerestory windows of a church, and it is most useful to run hot-water pipes underneath these windows for the reason already given.

Nowadays one often hears of the plenum system of heating and ventilating, but in my judgment it is not applicable to a church, though in new public halls specially designed the system might be advantageously employed.

In a church (and the same remark applies to a public hall) it would be sufficient if you made provision for the inlet of about 750 cubic feet per person per hour as low down as you can to the floor. The space should be heated to a temperature of about 60 degrees before the public come in, and when they are seated that temperature might be lowered,

so as to allow for the heat which is given off by the people themselves. You would then get a very pure air and you could arrange for its inlet at a low velocity. The warm air would rise with the respired air, and if the roof of the church were constructed in the ordinary way the air would find sufficient outlet through the cracks in the boarding of the roof. If this were not sufficient you could put in an aspirating shaft.

The next type of building I should like to deal with is a theatre. A theatre is an exceptional room. It is practically a place with no windows whatever in it, so far as the auditorium is concerned; it is very frequently surrounded wholly or partially by corridors; it has many galleries; and I think no system of heating and ventilation is of any value except the plenum, a system consisting in filling the space with fresh air by propulsion. The foulest places in theatres are not generally the pit or the stalls or the first circle, but if there are several balconies you will generally find it to be the foulest underneath the top balcony in the theatre. The gallery itself would not be nearly so foul as the balcony immediately beneath it. The balconies are very frequently constructed with a ceiling sloping upwards from the front towards the wall. This creates a pocket which is practically always unventilated. The heat there would be intense and you would find the air there would be very bad. Now if, instead of that, the balconies were constructed with a slight slope up from the wall to the front no such condition would arise. The air would then be driven out on the slope towards the centre of the theatre. The way in which plenum heating ought to be applied in such buildings is not by one shaft letting in fresh air. In my opinion this is ineffective. As a general rule I should recommend four, five, or six at different parts of the periphery of the auditorium under the balconies. By this means you would I think get the propelled air well distributed. The force is from the inlets towards the centre or open part of the theatre. The vitiated warm air would then rise with the ventilating influence, going from the people towards a central shaft. The shaft may be aspirated either by gas or by electric fans, which I think are the better. If this were done and the balconies constructed in the way I have suggested, I venture to think you would get an infinitely purer air than you ever find in an ordinary theatre.

The temperature of the atmosphere in an unventilated theatre rises to a great height, 73°, 74°, 80°, and very often I think you will find the CO_2 in such places is 23 to 30 volumes per 10,000, and it may be higher; the corridors and the halls all round should also be ventilated, and I think that their temperature should be somewhat less, but only a little less, than

that of the theatre, in order that these may have a tendency to ventilate towards the theatre without draught, so as not to act as a baffle on the plenum system, by which one is endeavouring to drive the air towards the centre of the theatre. The pit and the stalls can be heated in the way I have spoken of for heating churches, by having raised little platforms under the seats. The stage itself is a difficult matter. The stage should be cooler in temperature than the auditorium. If it is warmer all the vitiated air of the theatre drives on to the stage; if it is cooler a current would be set up which would not only assist the volume of air in rising in the theatre to the aspirating flue, but it would also assist the voices of the actors by carrying them towards the audience. Of course in a place like a stage there are doors opening, there is a great movement of scenery, there are the actors and the actresses, and the ballet dancers all causing a great movement of air. If doors are open from the street leading direct or by the corridors to the stage there are great draughts, bad for the actors and very objectionable to those who sit in the front part of the stalls or of the house generally. But if by radiators (which I think would be the simplest way of doing it) you were to heat the air as it comes from the external doors towards the stage you would, I think, get quite sufficient warmth for the purpose, and you would assist the ventilation of the theatre itself.

Passing on I come to factories. Here you have again an essentially different set of circumstances to those of the public hall, the theatre, or the church. You have people actively engaged; and a man actively engaged in manual labour gives off a great deal more CO_2 than when he is at rest. I believe it is something like double. In such places it is desirable to give a much greater volume of air than in a church. In the latter case I suggest 750 feet, but I think it ought to be 1,100 to 1,300 in a factory, the quantity depending upon what the people are doing. Cubic space per person is often looked upon as the great desideratum in giving them healthful conditions, but that is a great mistake. Professor John Scott Haldane some time ago showed that in a room where there was 10,000 cubic feet per person the results he obtained of CO_2 were worse than in any other place he had tried. I believe there were 16·5 volumes of CO_2 during daylight, and as many as 56 volumes per 10,000 when the gas was burning throughout the place. That was with 10,000 cubic feet per person!

Again, as I said at the very outset, all systems of heating are not applicable to every factory. In some processes of manufacture they find it desirable to exclude all fresh air, that is to say, air from the outside,

because of its injury to the fabric which is being manufactured. Then there are other processes. I think there is one which is called "gassing." It is a process by which some silk goods in process of manufacture are heated over gas, and there the fresh air which is required for the operatives is absolutely cold air, to neutralise the great heat which is given off from a gas apparatus. I have spoken to you earlier as to the porosity of a wall. Where there are large sheds and the superficies of the wall are small in relation to the area of the building, the atmosphere appears always to be worse than where the wall superficies are larger. Probably it is because you cannot get the requisite volume of air through the walls. I have mentioned to you about the bad results obtained in the large room with 10,000 cubic ft. per person. In a room where there was only 760 ft. per person (it is true they were sitting still and reading or at sedentary work) the worst they got with every inlet closed in the building was 15·3 volumes, as against 16·5 with 10,000 cubic ft. per person. This means, in effect, that the air in the large room with the 10,000 cubic ft. was only changed through the walls once in 24 hours, and this, of course, is exceedingly bad. Where operatives are using or working printing or similar machines they want a large volume of air, but they want it warmed to about 60 degrees. In a big shed, again, I think the only system of heating and ventilating which is applicable is the plenum, and I suggest that where there are many rows of columns a good arrangement would be to have, above the level of the head, horizontal ducts in which the warmed air could be carried to different parts of the building and distributed all over the place, so as to give to each operative, no matter what his distance from the external wall, fresh air such as he requires for his work. Then I would say that there should be no lifts or staircases within any factory, however high it may be. If there are, they simply become ducts of foul air, bringing up CO_2 from the lower floors. I have here, by way of illustrating my point, a plan of printing works that I designed some years ago in London. There are large rooms arranged in the form of a T, and between the arms I had an open balcony with a lift at each end of the balcony. They served every room all round quite conveniently, but they were external to the building, by which means they could not possibly convey foul air, nor were they a source of danger from fire. In like manner the staircases in these works were all external to the rooms and open to the fresh air from bottom to top. These are simply illustrations which show how one can apply the principle recommended.

I have now to speak about Hospitals. In hospitals the condition of the occupants is, of course, different from that in a factory or in any of

the other buildings that I have been dealing with. The patients are necessarily in weak health, and they are very few compared with the cubic space. The cubic space that is given is often, I think, much in excess of what is necessary for ventilation, but the object of the large space is, I think, to give convenience of access to the patients, plenty of room to get about them, to move their beds, etc. The ordinary ward as modernly constructed is a building that has windows on both sides. It is surrounded by air, it is flooded by sunlight, because generally the axes are placed north and south, by which means are obtained east, west, and south windows. In my opinion in such buildings it is very undesirable to have a plenum system of ventilation. I think it is infinitely better that patients should have open windows and, in any case, an abundance of fresh air drawn as nearly direct from the sunlit ocean as they can get it. What is the first thing you do with a convalescent? The first thing the doctor says is "Go into the open air, the fresh air, as soon as you can." I think an evil of the plenum system in a hospital is that it teaches patients to live with closed windows, which is absolutely opposed to what the doctors are trying to teach. Take the very prevalent disease, tuberculosis. To cure this, doctors are everywhere advocating open-air sanatoria, where the windows are always open, no matter what the weather may be.

Every story of a hospital should be separate from another. Where it is possible I advise you to keep the building without an enclosed staircase leading from one story to another. The staircase is better detached if you can so arrange it. In like manner the corridors should be open.

As to Schools, it is a very general and quite a modern practice to make the assembly hall with class-rooms opening from it. I think it would be much better, where space permits it to be done, to have the hall quite separate. In the Bluecoat School (Christ's Hospital) at Horsham, which many of you may have seen, that is the principle adopted. The school hall is a great detached building, the chapel is a great detached building, and the school houses are themselves detached. One must ordinarily have a series of class-rooms opening from a corridor. If so, there should be class-rooms on one side only of the corridor, by which means they could, whenever there was an opportunity, open the doors and the windows of the room and the windows in the corridor, and so get a clean blow through. In plenum-ventilated schools children are unconsciously taught to go home and say, "Oh mother, you must not open that window" (in a room that was fœtid perhaps) "we never open a window at school." Such education given to a child is distinctly evil. I think also that where

you have plenum air, though it is very nice it is slightly enervating, and if it is too much filtered and too much moistened it becomes "soft"; whereas you want, if I may use the expression, to make boys virile by giving them brisk and fresh air. You should preferably, I think, heat the classrooms on the system of fresh-air-fed radiators under the windows, and then have aspirating flues to take away the foul air and dust, with ducts and fans at the top, opening the windows whenever possible. By this means you would educate children to love open windows and love open air, and I think that would be a very sanitary doctrine on which to bring them up.

DR. G. H. BAILEY (Owens College) said some years ago, purely as a matter of interest, he asked the School Boards of Manchester and Salford to set at his disposal half-a-dozen schools in Manchester and Salford, 3 in Manchester, 3 in Salford. They were to select the schools, and he simply asked that those schools should be selected as being typical schools, and after his investigation he was satisfied that they were typical schools. There were amongst them representatives of their best ventilated schools, at any rate those on which they, he presumed, had spent most money in the ventilation and were satisfied ought to be the best ventilated, and there were types of schools which were badly ventilated. In the course of those investigations he came across a great deal of stupidity, common stupidity of the most unpardonable kind, with regard to ventilation. He came across such things as immense cooking stoves with no ventilation whatever provided, forgetting the fact that every cubic foot of gas consumed is certainly as bad as the effect of the presence of one child and nearly as bad as the presence of one man. Under those circumstances the air of a class-room with a cooking stove (because some of these class-rooms were devoted to cooking alone) must be something dreadful, and the teachers even admitted that it was not possible to do anything in the room without having the windows, not only opened, but wide open. Then another thing he was struck with was this, that in some of the best ventilated schools, or rather those in which the greatest precautions had been taken, the air was still very bad, there being as much as 15 and 20 parts per ten thousand of carbonic acid gas. He inquired in that case into the ventilation, he saw that the whole apparatus was doing all that it could be expected to do and that it ought to be able to achieve a better result. But the conclusion that he had come to was this, in general, that the movements of air currents had not yet been sufficiently studied. It was true they could not colour them red, or colour them blue, but by making careful tests of the temperature and composition of the air they could recognise what the current of

incoming air and the current of outgoing air were actually doing and how far mixture was taking place. In connection with other investigations he had made experiments which convinced him that if they had a current of air at a moderate rate, and if the differences of temperature were rather considerable, the warm air and the cold air hardly mixed any more than oil and water. There seemed to be a sort of repulsion, and that fact he did not think was half enough recognised. Frequently in the case of these rooms air was coming in there, it was going out here, and they could trace it crossing, and absolutely the rest of the room was being unventilated. Now, of course, one solution would be to admit the air at a high velocity that would set up a vortex current and would bring about a mixing of the air. But they would say, to have air at high velocity was impossible, impracticable, 5 feet a second was the maximum rate which was admissible without draught. But then there was surely no reason why they should not make these rapid currents of air impinge on something which should distribute them and mix them with the rest of the room, and thereby indeed help the problem. Anyhow, certainly it seemed to him, from the little experience he had had, that the mixing of the air was a very important matter in any system of ventilation. He thought there was one point in which he could hardly agree with the speaker, when he gave them to understand that the quantity of carbonic acid gas within a short distance of the floor was somewhat similar to that near the ceiling. As a matter of fact he had made numbers of tests on that point and they might take it for granted that by far the worst air was always near the ceiling, that it went up in a sort of rising gradation. He had made tests at various heights and it had been established, he thought, several times.

MR. HALL: Was that in a gas-lighted room, or a room without any gas-lights?

DR. BAILEY: That was in a gas-lighted room.

MR. HALL: I agree with you. That is not my point. I am speaking of the day-time absolutely.

DR. BAILEY said he had made tests also without the gas-light in an ordinary room. His experience at any rate always was that the air near the ceiling was the worst air in the room. He was speaking of a closed room and not air that was pushed out by any means. As a matter of fact they could eliminate the idea of the heaviness of carbonic acid gas altogether, he thought, because what influenced the circulation and the movement of the air in a room was not the gases at all (the mixture of the gas which took place on diffusion and the currents of the gases) it was merely a matter of temperature. Heating and ventilation could hardly be separated, and in his opinion the only way to heat a building like a church, which was usually a building with massive walls, was to heat it over a prolonged period, keep fires in the place continually, and if they

you have plenum air, though it is very nice it is slightly enervating, and if it is too much filtered and too much moistened it becomes "soft"; whereas you want, if I may use the expression, to make boys virile by giving them brisk and fresh air. You should preferably, I think, heat the classrooms on the system of fresh-air-fed radiators under the windows, and then have aspirating flues to take away the foul air and dust, with ducts and fans at the top, opening the windows whenever possible. By this means you would educate children to love open windows and love open air, and I think that would be a very sanitary doctrine on which to bring them up.

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once got the walls and the fabric of the church warm they would not be troubled by draughts.

Mr. J. Corbett (Salford) said he should like to call attention to two leading principles of ventilation. They could emit a draught from a tube or a channel and give it direction, and by judiciously multiplying and distributing air inlets they could carry streams of fresh air into every part of a building. But on the other hand they could not direct the suction. The air came from all points of a globe round the outlet equally. It did not matter whether the pipe was pointing upwards or downwards, there was the leading point. They could direct an inlet; but they could not direct an outlet. Therefore, some of the arguments that were often used about the fire being at a low level drawing air along the floor, or the opening being at a high level drawing air along the ceiling, were, to some extent, fallacious. It was a matter of common knowledge, and everybody seemed to acknowledge it, that if air was heated it would ascend. People were apt to forget that if they cooled air it would descend just in the same degree. He had a very telling instance of that some years ago, when he had occasion to visit a number of fever hospitals in winter time, where he found that beneath the windows (generally lofty windows in lofty rooms) there was a keen downdraught bringing the foul air from the ceiling by reason of the cold draught of the window. It was more perceptible there than anywhere else. As a remedy for that, they wanted hot-water pipes high up in the room to prevent the hot spent air from descending. It was the practice in Lancashire to heat loom-sheds by putting pipes aloft and none below because the lower space was valuable; and that had really a beneficial effect when combined with proper inlets and outlets. A point on that he should like to refer to, that in any room, however large, within reasonable limits, he thought it was always advisable to have only one outlet. If they had more than one outlet the odds were that one outlet would become an inlet and gave a cold shower bath of air coming down from the ceiling. As to the inlets he should say, make as many inlets as your limits of money will allow; let it be tempered air, only tempered, not by steam nor by red-hot surfaces, but of all things by hot water, and, if possible, do not draw directly through the walls, because then the inlets were subject to wind effects. The true principle, if they could adopt it, was to bring air in from more than one source or from a well isolated source. Sometimes in a building they could bring air from both sides into a chamber in the basement, which would draw to different parts of the building, and the wind blew through that chamber if it was blowing strongly from one side to the other. Another plan, also very efficient, supposing that they had open grounds near the place, was to have a shaft raised a little way above the ground. For instance, at the Salford Technical School they drew air downwards from a shaft in the public park some 40 yards, perhaps, away from the building, and the air passed through a channel underground and so to the ventilating fans and into the building. The wind had

absolutely no effect upon it. There again they had an outlet by a shaft with also a fan in it. They had both plenum and aspiration ventilation there.

A LADY MEMBER asked if the reason for putting the heating apparatus so high up in loom sheds in Lancashire was not so that the dust might be carried away from the works, as well as the smallness of the space lower down.

MR. CORBETT said he doubted whether the factory owners went in for such niceties as that. He believed the financial question was almost the sole consideration that ruled the construction of an ordinary loom shed. They wanted the whole floor space and therefore they raised the heating apparatus. They got accidentally very great advantages, but he doubted very much whether the ordinary factory owner or factory architect thought so much of the niceties.

DR. W. F. DEARDEN (Manchester) said he intended to confine himself to the particular branch of ventilation in which as a factory surgeon he was more immediately interested, that was to say, the ventilation of factories and workshops. Factories and workshops were practically the only places that had been really legislated for, as far as ventilation was concerned, and even those not to a very great extent. The ventilation which certainly had been worked out very well in factories was what one might call special ventilation. From the Factory Act of 1878, provision had been made for the carrying away of dust generated in various manufactures, and then in the Act of 1895 this was extended to the generation of gas in various processes. This legislation had undoubtedly a very educative effect, because when they were compelled to do something, people set their wits to work to devise means for attaining the particular end, and so the present state of the special ventilation of factories and workshops, or factories he might say, was of a very high order; in fact it was far ahead of any such suppositious method as putting hot-water pipes into the ceiling to take away dust or gases generated in the process of manufacture, mentioned by the previous speaker; he thought they had got a step beyond that. But he thought this educative method deserved to be imitated a little more in general ventilation. The provisions for general ventilation under the Factories Act were very short, with one notable exception, the Ventilation of Cotton Cloth Factories Act. That was the only Act of Parliament that fixed a standard of ventilation. It was a great pity that a standard of general ventilation could not be fixed for every public building; the working man in this country generally got the first consideration, and he certainly got it in this case. Possibly, many of them would know that the last Factory Act of 1901, based, of course, upon the experience of the Cotton Cloth Factories Act, decided to give the Home Secretary powers to make an order for factories and workshops generally. But unfortunately, up to the present that had never been utilised. The difficulty he wished to illustrate was this. Many of them would be aware that a Commission, or a Committee, had been appointed to make observations on ventilation of

factories and workshops and to make recommendations. That Committee had published a report, and that report had got plenty of good material in it and showed plenty of very excellent observations; but as far as the recommendations went, they seemed to him to be far short of what those who were perhaps qualified to judge on the matter thought should have been recommended. According to the recommendations, the Committee wished to fix a carbonic acid standard of ventilation, and this carbonic acid standard, instead of taking the standard that had acted so well in the Cotton Cloth Factories Act, 9 volumes in 10,000, was practically 13 volumes. That was a recommendation which did not appear to him to be in the right direction. Instead of lowering the standard to that extent one would have expected they would raise it. From the observations of the Chief Inspector of Factories upon the tests which had been made, it appeared that during daylight 65 per cent. showed a proportion of under 10 volumes per 10,000, but in spite of that they recommended 12 volumes per 10,000 as a limit, but no prosecution to take place unless 13 volumes per 10,000 be found. If there were 65 per cent. that came within the limit of 10 volumes per 10,000, surely if they wished to fix the new standard at 13 volumes they might just as well leave it alone, because he thought they would probably find that all the factories and all the workshops would pretty nearly come up to that standard. So that appeared to be legislation in vain. They went a little further as regarded gaslight. No standard had been made previously for gaslight, but they recommended a very low standard indeed under this head. They recommended 20 volumes per 10,000 as a standard, and then further that no prosecution should take place unless there was another volume ahead of that, that was 21 volumes for gaslight. Of course, any such order would have to be submitted to Parliament and possibly it would create a great deal of discussion. What had always satisfied legislators had been to fix the amount of cubic space. Fixing the amount of cubic space per head was no use whatever. But when they came to a standard of ventilation that was insisting on, say, a certain limited percentage of carbonic acid, or certain means for changing the air so many times per hour, then they got to something important indeed. If anything could be done to impress upon the Government the necessity of creating these standards of ventilation and at the same time the necessity of greater efficiency in the methods of ventilation, he thought they should be able to do some good. He should like to see the time when not only factories, but public halls, schools, churches, and everything of that kind should be compelled to have a standard of sufficient ventilation.

Dr. Howson Ray (Manchester) said for over four years he held the post of medical officer to the Salford School Board. Ventilation was probably the most pressing of all the problems a medical officer to a School Board had to face. He should like to say, first of all, that he had a strong feeling against the plenum system as applied to school buildings. He would admit frankly that his

experience was somewhat limited. It was limited to the examination of three schools. In a school ventilated by this plenum system he found (and he made these tests himself using the ordinary method of Pettenkofer) as much as twenty-two volumes of carbonic acid in rooms that were ventilated upon a plan somewhat similar in its superficial features to that in use in the room they were in. There were twenty-two volumes instead of, he should say, six volumes in the 10,000. He should add that outside that school the percentage of carbonic acid was rather higher than the London average or the general town average. It was as much as 5·1 volumes, therefore they were dealing with a somewhat vitiated state of the air, but still a rise from 5·1 to 22 showed that the advantages which were claimed for the system were, to say the least of it, extravagant. He had carried out actual experiments on the different strata of air, not right up at the ceiling, but at different levels. He found that in daylight the percentage of carbonic acid was higher the higher he went. Another point was this, as showing the importance of ventilation in their schools. The fullest use was made of all methods that were to hand, and he attributed very largely to that fact the result as regarded the non-closure of Board Schools in the Salford district. During the four years that he was medical officer only one school under the late School Board required closing on account of infectious disease. In the Salford Royal Hospital great use was made of what was known as the Boyd ventilating fire grate, and it was found most efficient. It was a fire grate with an air chamber drawing in air from different inlets, and then distributing it above the level of the fire-top, and finally this same air, or rather air mixed with it, passed out by a shaft parallel with and surrounding the smoke stack. That they found very efficient. He should like to read part of a schedule drawn up, on the ventilation of schools, for the use of teachers. It was a series of directions to the head teachers of schools.

The following instructions are to be carefully observed by the head teacher:—

1. The means of ventilation should be used.
2. Air inlets and foul-air outlets should be suitably opened, and kept free from rubbish and dust, and from being covered up by maps, blackboards, &c. A reasonable amount of draught is less harmful to health than is the breathing of impure air.
3. Windows should, where possible, be used to the fullest extent, and be so managed—by experimenting with the degree of opening—that a minimum of draught with a maximum of a change of air supply is attained.
4. Overcrowding in rooms and overcrowding in a class (placing the children too near to each other) should be avoided, as far as is consistent with fair administration of the class for teaching.
5. Where high winds prevail and windows are practically the only means of ventilation, those placed on the windward side of the room should be opened slightly at the top, and on the leeward side of the room they may be opened much more widely.
6. During playtime all doors and windows should be widely opened so as to flush the rooms with fresh air. At the dinner hour enough windows should be left open to attain the same object; and before the commencement of the morning school and at the end of the day's work, doors and windows should be left open sufficiently long to freshen the air of the room.

7. The school caretaker should have the doors and windows widely opened when sweeping the floors, and after washing the floors and furniture.
8. In cases where many instances of sickness (in its various forms) occur in one class of children the means of ventilation should be examined, and if found to be faulty a report should be sent to the clerk without delay.
9. All assistant teachers must carry out the above instructions, and so co-operate to obtain more efficient ventilation.
10. Some opportunity should be taken to explain to the children the need for fresh air, and to let them see this teaching put into practice.

Discretion must, of course be used in opening the windows before school in severe weather, as the opening of the windows at such times may prevent the school from getting properly warmed. In schools where any mechanical system of ventilation is provided, the head teachers should make themselves familiar with the system, and see that the instructions of the ventilating engineers are carried out.

Mr. H. E. Stelfox (Manchester) said the lecturer had spoken of applying heat to clerestory windows, but it was found in his own experience that the air was chilled by almost all the windows in churches, and currents of air were set up discomforting to the people who were sitting near. This chilling of air at the windows of churches was brought rather forcibly to his notice in connection with one of the schools of which he was the architect. After the school was opened and the work was going on a complaint came that there was a down draught from the roof extractor: this was in the central hall. He thought it was not very likely that that could be the case, and he went to make experiments. He found that the roof extractor was acting properly, and then he suggested that it was probably through the window side of the central hall facing north and having rather large windows, that the air was chilled and came down in a cold current on to the teacher who was sitting between two of the windows with her back to the wall. In order to remedy that, an extra radiator was put on either side of the teacher, and there had been no further complaints on that account. It was proved, he thought conclusively, that the cold current was caused by the descending air after being chilled at the windows. With regard to one point mentioned by the lecturer, the isolating of the central hall, he was afraid, although that might perhaps be done in certain schools of the grammar school type, it would be hardly possible or advisable in the elementary and other schools, at any rate of Manchester and Salford and this district, because it was found in the working of the school that it was of very great advantage to have the children passing from the corridors into the central hall and turning out of that central hall into the class rooms. He was very glad to hear that Mr. Hall did not advocate the plenum system in schools. He came there almost fearing that he should have to combat an order to immediately start putting the plenum system into schools. He was in agreement with the lecturer's remarks regarding the ventilation he recommended. He was supported in that by the fact that some two years ago he made a tour through Germany

inspecting the lunatic asylums there, which were now being instituted on the colony system. He found that the schools, generally speaking, were heated by means of low pressure hot water radiators, in many instances heated from a central heating station, the steam being conveyed to calorifiers and the water warmed and distributed on the low pressure system. On the other hand in most cases there was no extraction flue at all from any of the rooms. That seemed to him rather curious, and he spoke about it to the medical officer who was showing him round. He explained that they had gone very closely into the matter, and that they relied, and preferred to rely, entirely upon the open windows. The windows were kept very freely open and there was constant change of air by that means. He did not say that he recommended that, but the argument was that the more fresh air these people had the brisker they were and the healthier and the more cheerful.

MR. J. D. SUTCLIFFE (Manchester) said that Mr. Hall's remarks had been full of useful hints and suggestions. The idea of sloping the ceilings of circles and balconies upwards towards the centre of the theatre instead of the now universal way of sloping them in the other direction was a valuable one from the health point of view, and he hoped the County Council and other authorities would adopt it. He thought good ventilation included more than a supply of fresh air and the extraction of vitiated air. The main point seemed to be the diffusion of the fresh air, and this was where ventilating engineers usually failed. For instance, in that very room it was plain to see from the ribbons fixed to the air inlet registers near the ceiling that a large amount of air was being blown into the room, and that the only outlets were at the fire-places at each end of the room. Now he felt sure that most of the fresh air coming in travelled in a very direct line to those outlets and that there was little diffusion. To obtain good diffusion required space and a plentiful supply of inlets and outlets, and he did not agree with Mr. Corbett when he stated that one outlet for the air in a room was as good as a large number. In dealing with drying rooms, where an even and fixed temperature was essential, he found that the more numerous the outlets the better the diffusion and distribution of the air and the more even the temperature. The old chemists called oxygen "vital air," but the chemists here seem to differ with each other as to the behaviour of carbonic acid in the air, and especially in its diffusion in a room. The late Professor Carnelly said: "The carbonic acid gas from the breath of a man standing upright does not diffuse until it is within two feet of the floor." He thought that statement generally correct, but it would require modifying according to the temperature and crowded state or otherwise of the room where the tests were taken. For instance, there must be an immense difference in the diffusion of the CO_2 in a weaving shed and a theatre. In a weaving shed the CO_2 has to be kept down to nine parts of carbonic gas in 10,000 parts of air, and each operative usually has 400 cubic feet of space for the diffusion of the 3,000 cubic feet of air per

hour supplied to him. In a theatre each occupant has frequently only about 25 cubic feet of space and if 3,000 cubic feet of air per hour were supplied to each person, this being the amount required to maintain the same standard of purity, the effects would be extremely disagreeable, and such as to put the question out of the range of practical ventilation.

Dr. Crowley (Bradford) said, first of all, with regard to the ventilation of hospitals and schools, the conditions were utterly and entirely different. In hospitals they had patients to whom they could easily give a large amount of cubic space, and there they were for the whole day and the whole night; and he knew of no method of ventilation of any use at all in a hospital other than what was called natural ventilation. The hospitals to which he belonged were ventilated in that way only. In one of them particularly, for which he was solely responsible, the windows were always open day and night, and the patients soon got accustomed to having the fresh air all round them. He ventured to think they could not apply that principle necessarily to schools. There they had conditions utterly different, they had a very large number of children in a comparatively small space for a comparatively small time. He had had the advantage of comparing mechanically ventilated schools with those which were not so ventilated. It was not practicable, as suggested by the lecturer, to have schools built in such a manner that each class-room opened into a corridor communicating with the outside and so ensuring a complete flushing of the room. Practically they had to have a central room with the class rooms opening out of it, and he had never yet seen a school which was properly ventilated by ordinary means. He admitted they could do a great deal more than was done to make them better, but they must begin by teaching hygiene to the teachers. Now with regard to the disadvantages of mechanical ventilation in schools, or rather let him take the advantages first. Dr. Kerr, his predecessor as Medical Superintendent of the Bradford School Board, showed in a report of his how much superior the mechanically ventilated schools were to those "naturally" ventilated. Undoubtedly one or two of the older schools mechanically ventilated were not altogether satisfactory, but given a decent caretaker, given a good superintendent of caretakers as they now had, they could get those worst schools into very good condition; the objections raised were nearly always objections which could be done away with by detailed care. In their latest school where they gave each child 1,800 or 2,000 cubic feet per hour (there was no juggling about that, it was a fact, they got it) the was air always pure and fresh, provided that the caretaker was doing his part. He knew there were drawbacks; but with regard to the disadvantages, considering that he was also a physician to a sanatorium and a lecturer on the prevention of consumption, he thought they would not accuse him of not believing in the use of fresh air, but they could not have everything. He admitted some force in the objection as to its being a bad education for the children to have the school windows

closed, but the system and the reasons for it could be simply explained to them, and they could be shown the trouble that was taken to supply them with pure air. He thought the plenum system had not reached its perfection, but the gentlemen who had spoken to some extent judged it by failures and not by successes. There was one thing which it appeared to him could be done with very great advantage, only there they must rely upon the common sense of their teachers in the mechanically ventilated schools. When the children were out they might if they wished, especially if they had a double duct system, as they had in their latest schools, have the windows wide open and get ordinary fresh air, and then when the children were all in again close the windows. A school mechanically ventilated and looked after with intelligence (and unless this could be secured he admitted the system would prove a failure) ensured a stream of pure air going through the school, and the result obtained would be found much superior to the ordinary method of ventilation of their schools.

MR. A. M. FOWLER (Manchester) said there was a very important practical remark made by Mr. Corbett, the truth of which came under his notice whilst in Leeds, when called upon to ventilate the cells of the Leeds Borough Gaol. There, there were several wings to a very large building, radiating like the leaves of a fan, and each cell was ventilated by means of hot air. They all knew that carbonic acid gas fell so soon as the room cooled, that was to say, the warm air assisted it in rising to the upper part of the room, but when the room was chilled it fell. Now the system adopted in the gaol at Leeds was to send in the warm air at the top of each cell and extract the vitiated air from the bottom. Every cell had two flues, one a warm air flue bringing in the warm air at the top, and the other the extract flue at the bottom. Those were taken up into the roof, gathered into a shaft and conducted to a tower. To prove the efficiency of that ventilation, which was thoroughly practical, he had several times gone up to see how this ventilation was working. He might say there was a door on each of these towers. He could not put his head into that door opening for the stench, and he had no doubt it was the carbonic acid gas which was drawn off. They had conveniences in the cells and they were the worst places possible to ventilate. Therefore, Mr. Corbett's illustration of the worst smells being close to the window where the warm air was chilled was confirmed; he would no doubt feel the carbonic acid gas, which was most deadly as they knew. With regard to the ventilation of workshops and driving off the dust, he thought they need not go very far to see a good illustration of that, at Mather and Platt's works at Salford. Mr. Mather looked after his workmen and took good care of them. They had everything that a master could give them, and one of the principal things which he did was to ventilate their workshops. They had an extract flue in each room which not only took dust but almost everything. They felt no draught whatever, but if they put anything near, within some yards of these extract flues, which were on

the floor, it was carried away; they took shavings and everything bodily up into the roof right away, proving that the draught took everything possible out of the room. Natural ventilation was one of the most difficult things that they had in this country, to be applied safely. In summer time, when the atmosphere outside was perhaps at 80, there was no difficulty from the sunlight and the warmth outside, everything went out of the window. But when they came to the winter time, and had their warm comfortable room at, say, 70 degrees, and the atmosphere outside was at 32 degrees, perhaps below freezing point, they could not have the window or the ventilator open. Then the downdraught was felt passing into the warm room, and went up the chimney flue. Well, perhaps the remedy was worse than the disease in such a case as that, because whatever they might say with regard to fresh air, children, and grown-up people too, could not stand such fearful draughts as they sometimes got under such conditions. Now that electric lighting was so universal however, he might say it was quite a simple matter to have flues at the bottom by preference, and they could just hook off any of their connections and put in a small electric fan, and make an extract at once. It was artificial ventilation certainly, but if they had electric light in their house ventilation could be obtained at a cheap rate, and it was a thoroughly practical operation.

Mr. Preston (Lancaster) said, with regard to the pipes being fixed under the windows high up in a church or in similar places, he might say that point had been brought forward a good deal in the case of churches that had gas and now wished to have electric light. In many cases the congregation found considerable draughts on substituting electric light for gas. Of course naturally they came to the conclusion that it was a bad roof or there was some fault in the extract ventilators, but nearly always it was found that if hot water pipes were run along under the clerestory windows it considerably lessened or stopped the downdraught. Of course, it depended upon the form of roof whether it had much cooling surface, and the position of the windows. With reference to the remark made by Mr. Corbett as to one outlet in a room overcoming another; if there were two extracts in a similar position, or one perhaps slightly different from the other, sometimes one did overcome the other; but he thought that in preference to having one extract in the room, if they had one common extract on the roof and two or three branch extracts in various parts of the room leading to that common extract, then there could be no reversal of the current.

Professor Radcliffe (Manchester) said they had before them the plans and sections of the air ducts throughout that large building, the Manchester Municipal School of Technology. They would understand that the ventilation of that mass of brickwork required a good deal of attention. The following statement had been circulated showing the capacity of the fans and the

methods of changing the air, and he could only add that they found it very efficient:—

The air is drawn into the building through two large ducts (the height of the inlets above ground level may be varied from 25 feet to 70 feet) by two special 240 three-quarter housing pulley fans. The wheels of the fans are 12 feet diameter, composed of 10 blades, 5 feet 10 inches wide by 2 feet 6 inches deep, with a speed of 132 revolutions per minute, and with a clear inlet and outlet each fan will pass 200,000 cubic feet of air per minute. This quantity is sufficient to change the whole atmosphere of the building in 18 minutes or 3¼ times per hour. The air delivered would supply 8,000 people with 3,000 cubic feet each per hour. Each fan is driven by a 40 B.H.P. electric motor, with a speed of 665 revolutions per minute. Each motor takes 165 amperes at 220 volts. The air is washed immediately it enters the ducts, before it reaches the fans, Sturtevant wet filters being used for the purpose. The filters are formed of about 100 galvanised corrugated iron sheets 10 feet by 2 feet 3 inches, fixed on edge ⅜ inch apart, completely filling the air inlet duct. Six very fine water sprayers are fixed above each filter, with a water pressure of 50 lbs. per square inch, each jet discharges 20 gallons per hour. The air and the spray pass between the corrugated sheets and deposit about 75 per cent. of the impurities in suspension on the corrugated surfaces. This is washed off by the water and carried to the drain. Immediately the air leaves the fans it is warmed to the required temperature by steam heaters. The heater consists of 10 sections of 4 rows, each 8 feet by 6 feet, and contain 1,060 feet of 1 inch steel pipe. The steam connections are arranged so that one or more sections may be used with live steam, or with the exhaust steam from the electric generating engines of the school. The air is conveyed to the rooms by the double duct system. One duct is used for warm air, the other for cold air. One or more mixing dampers are fixed in each room to be used as required, but the volume of air discharged through each opening is not varied except by the engineer in charge.

MR. HALL (London), in reply, said he had listened with great interest to Dr. Howson Ray's remarks with reference to the plenum system for the heating of schools, which he had himself tested, and also to Mr. Stelfox's remarks on the same subject. Now Dr. Crowley told them of his experience in Bradford. He hoped Dr. Crowley would forgive him, but he went over one of the very latest of the Bradford schools a very short time ago and it was plenum ventilated. He visited it with two or three other professional men, and they went into a class room out of which the children had just come. The first observation that one of his neighbours made was, "What a fearful smell!" It was the objectionable smell which they got in a badly ventilated room. They went into another room. He put his handkerchief against the inlet ventilating flue and it drew his handkerchief up against the grating; it was acting the wrong way. The school had been open about two months. The other objection he found to the system was that if they went into the flues, though there were most admirable screens, they would find the flue walls were covered with soft, black dust. He had seen that again and again in plenum flues. They would say, "You can always wash them." So they could, but it was expensive; they could not wash them every minute, and they were constantly getting foul. They could not in fact get rid of all the dust that came in, although they got rid of a lot, where they washed and screened the air. Dr. Crowley told them also that the best naturally ventilated school was worse than the worst of the plenum

ventilated schools. That might be because he was comparing a new plenum ventilated school with an old school where ventilation had not been studied at all. In most of the schools which were erected, until a few years ago the promoters never thought about such a thing as the study of ventilation. They put in windows but they did not think to direct currents, they did not think to warm currents, and of course they could not during lessons have a window opened letting in air at a temperature of 32 degrees. They must, in fact, study to do the ventilation scientifically, by whatever method they attempted to do it. The principle, as he understood it, of the ordinary plenum-heated room was that they forced air in, put the atmosphere of the room under pressure, and tried to press air out, either through the outlet duct or through the doors. Dr. Crowley told them that with the plenum system they had the advantage of teaching children that they must get fresh air in. What use was that to an ordinary child in life? They taught the child that he had to get it in by a fan. He could not do it in his house. It might be done in a factory where there were bodies of workmen, but there it was done by the authorities for the men. To teach a child that he had to depend on an artificial system of ventilation all his life was, he thought, dangerous teaching; they had better teach him that he had got to depend on fresh air, and that he should encourage the opening of windows. It seemed to him that what was learned by children at school was learned as much by visual observation as by aural reception. With reference to the question of the diffusion of CO_2, he believed chemists said the explanation was this, that the CO_2 which was respired from a person was something like 37 per cent. heavier than the natural air (perhaps they would correct him if he were wrong) but the volume of aqueous vapour which was given out was (he thought) 42 per cent. lighter. The gases appeared to agree to strike a balance between themselves, and the result was that practically the mixture became of the same density, the same specific gravity, as the ordinary air. That was apparently why they would find at different levels in an ordinary room almost the same amount of CO_2. His authority for that statement was Professor Haldane, who had made most careful and most detailed tests. He took a test at 2 feet, then he took a test at 4 feet, then a test at 8 feet, and a test within a foot of the ceiling, and the results were practically identical right through the series. This would not, as he said in his opening remarks, apply to a church. He thought what he had said answered the observation which Mr. Sutcliffe made, practically on the same subject.

DISCUSSION ON

ROAD SANITATION.

Opened by J. PATTEN BARBER, M.Inst.C.E.,
Borough Engineer and Surveyor, Islington,

And LOUIS C. PARKES, M.D., D.P.H.
(FELLOW),
Medical Officer of Health, Chelsea; Consulting Sanitary Adviser to H.M. Office of Works.

At Sessional Meeting, Wednesday, February 10th, 1904.

J. PATTEN BARBER:

IT is not with the view of being able to tell anything that is new respecting road sanitation that I responded to the invitation given to me by the Council of this Institute, but that I am anxious to do all I possibly can to assist in the discussion of this very important subject. In country districts it has hitherto been scarcely necessary to take into account sanitary construction in connection with road-making or maintenance, the only requirements being a sound, compact, and enduring surface, all which were met by a well-made macadamised road. But the increasing use of motor vehicles, especially of those travelling at great speed, will no doubt necessitate either the construction of dustless roads or the adoption of means for the prevention of dust being raised by vehicles from the ordinary macadamised roads. The first of these alternatives could be complied with by replacing the ordinary macadam with tar macadam, which, though a more costly material, is, when laid, freer from dust and mud than the most perfect macadam road can ever be; the second alternative would probably be provided for by treating the road with a material of an oily or tarry nature, as has been done with some success in various places during the past year. For town roads, especially those over which a great number of vehicles pass, sanitary requirements are, if not of prior, or equal importance to those of foothold and ease of traction, and assuredly should be placed no further away than next to them when

materials are under consideration. In the case of macadamised roads the question of the priority of sanitary considerations can hardly be disputed. When such roads are largely used by vehicles they are found to be incapable of resisting the effect of heavy traffic, whilst the large quantities of dust and mud produced by the combined effect of traffic and weather on the road coating have proved macadamised roads subjected to heavy traffic to be costly to keep in repair and in a cleanly state, and exceedingly difficult to maintain in a satisfactory condition for traffic, public health, or convenience.

Some few years ago I had under my charge a macadam road in Islington through which some 500 omnibuses were passing daily. The road was wide and everything possible done to keep the road clean and to prevent offensive smell from it; orderlies were employed and the road was washed thrice weekly and well drenched with deodorising liquids several times daily throughout the summer. But notwithstanding this work the smell from the road became abominable and unbearable. This case is mentioned to show that whatever care be taken it is impossible to keep a macadamised road exposed to great traffic in a sanitary condition, and that such material is altogether unsuitable for a busy thoroughfare. Unfortunately sanitary authorities, though recognising the necessity for replacing the insanitary macadamised road by some more substantial and sanitary pavement, have to consider, as the road authority, the question of cost, and unless it can be shown that a saving in the annual expenditure on the road will result from the abolition of macadam, there is a natural hesitancy to make the needful change in view of the spectre of the next election when those ratepayers whose ideal representative is one who keeps down or reduces the rates, condemn the man who considers the public health of greater importance than the mere saving of expenditure.

If, however, the health of the people is to be the first consideration, the macadam road under heavy traffic will be found to be the most costly form of construction, excluding of course such material as flint. The cost of keeping such a road in the same condition of repair and cleanliness as a paved road would greatly exceed the expenditure upon a road of the las mentioned character. A macadam road which it is necessary to coat so frequently as once in from two to three years should be converted into a paved road, for if all the advantages which would result from such a change were considered, it would be found that the expenditure on the work would be amply justified. There are many miles of these roads in the Metropolis from which large quantities of dust and mud are carried to the paved roads forming the main lines of traffic, so that if the necessary

paving were done it would benefit not only those residing in and passing along the macadam roads, but also the much greater number who are found in the busiest thoroughfares. The important work of reducing the quantity of dust in the atmosphere would also be greatly assisted by the paving of such macadam roads as need coating as frequently as I have stated. The road which would find favour with those who look only for one that is perfectly sanitary in construction might perhaps be described as formed of a smooth, hard, non-absorbent material, incapable of being indented or deformed by traffic, of being softened by any atmospheric temperature or disintegrated to any appreciable extent by weather or temperature, which could be laid in a homogeneous mass, without joints, and so placed and shaped as to admit of water easily flowing to the gullies. In selecting the material which would enable him to form this ideal road the engineer has not so great a number as to cause bewilderment. At present it seems there is but one which approaches the standard described, asphalt. Even this material has disadvantages which prevent the construction of a perfectly sanitary road, for as only compressed asphalt is suitable for vehicular traffic, it cannot be laid to that perfectly true shape which the ideal road should have, and the finished surface has innumerable depressions which, though of small depth, render it a little short of perfect. But the facility with which an asphalt road can be cleansed, the small amount of dust produced by its abrasion, its freedom from joints, and its non-absorptivity, seem to place it first as a material for sanitary road surfaces.

It is necessary to remind you that sanitary considerations only are under consideration, and the views expressed are not to be taken as applicable to the suitability of this material for giving a satisfactory foothold for horses shod as they are now. Wood pavements have the disadvantage of many joints and are absorbent, but the former can be greatly reduced by the use of bituminous grout for filling the joints, and the latter by creosoting the blocks under pressure or by the use of hard wood for paving. Hard wood, however, shrinks considerably in dry weather; the blocks then become loose and the joints enlarged. The insanitary conditions produced by these changes are easily discernible in the roads. I have never seen similar changes in creosoted deal, the reason being that the fibre of the blocks being compressed by traffic is bent over the joints and effectually seals them. A very accurately shaped road which is easily cleansed can be formed with wood blocks, but after a few years, the blocks, wearing away unequally, produce a surface not so easily kept clean as that of an asphalt road, which, owing to the greater and

more uniform homogeneity of the material, remains with a more even surface to the end of its life.

Granite sets, if the joints be filled with bituminous grout, make a practically non-absorbent road, but noisy and not so easily cleansed as the other paving materials mentioned. It appears that the authorities in large towns are prevented from adopting the material which would make the most sanitary road surface for the principal thoroughfares by the consideration which must be given to the necessity for providing a road which will afford a good foothold for horses. It is worthy of consideration, however, whether it is not possible for a mode of shoeing to be devised which would relieve the authorities from thus having to subordinate the health and convenience of the people to other claims.

But the most perfectly sanitary road construction is of little use unless attended by an equally perfect system of cleansing. The most suitable material for the road having been laid with the greatest care and skill is at once the receptacle for dirt and filth from various sources. The greater part of the dust and filth in the principal streets is no doubt contributed by horses, and this is less objectionable in wet weather, but in dry weather, after having been ground into fine dust by the traffic, it passes into the air and becomes part of the town's atmosphere. The time is not near when horse traction will be superseded by motors, or it might be stated that the chief source of road pollution was soon to be stopped. It is therefore necessary that the arrangements for producing and maintaining sanitary roads should deal with conditions as they are, and that whilst lamenting the amount of preventable dirt which is found in the streets, and taking all available measures for stopping it at its source, the best available means should be adopted for promptly clearing away everything in the shape of dust, refuse, and filth from the streets. A well-organised system of orderlies for removing filth and refuse during the day, and a thorough washing by hose or water-vans and machine brooms daily, is the least that can be done to busy streets, unless they have been sufficiently washed by rain, or the lowness of the air temperature renders washing dangerous.

A plentiful and cheap supply of water is an absolute necessity for the thorough cleansing of the principal thoroughfares; and a sufficient staff of intelligent workmen, who are active, alert, and capable of exercising judgment in the execution of the work, instead of the ignorant labour with which those responsible for street cleansing are too frequently handicapped, and yet are expected to produce results which are only possible with intelligent and active workmen. The freeing of a road from semi-

liquid mud or slop is a simple operation, but the removal during the daytime, from a road crowded with traffic, of the thin film of greasy material which causes horses to slip in a manner too well-known, is a most difficult, if not an impossible task. Owing to the extreme thinness of the material to be removed, it is unaffected by any tool that can be applied to it, whilst any attempt to wash it away by first watering the road and converting the greasy substance into slop, might unduly interfere with the traffic, and would certainly be much complained of by pedestrians; although a shower of rain, which would have the same effect as the watering, being a natural occurrence would evoke no comment. Limited as he must needs be by a regard for public opinion and convenience, the borough engineer has but one remedy available for a road in the condition referred to, viz., to make a temporary surface by a plentiful sprinkling of sand or fine shingle, and to thoroughly wash the road at night. The removal from the roads of the mud and slop which are produced in unlimited quantities in wet weather, is never, one may safely say, carried out in a manner which satisfies the public. But these requirements are frequently as reasonable as the estimates of the depth of mud on the roads, which is always either ankle- or knee-deep. The work can be done in a reasonably efficient manner, and well enough to satisfy any reasonable critic, if a sufficiently numerous staff and the necessary amount of supervision be provided; this, however, cannot be done without considerable expense. The public too often imagine that the roads can be cleansed much more frequently without the employment of more men or an increased expenditure. The whole difficulty of satisfactory cleansing is one of expense. It involves the supply of a proper number of men, sufficient plant and equipment, and adequate supervision. The engineer *can* keep the roads in a satisfactory state of cleanliness, but he cannot do it unless he is provided with the means. The evils wrought by undermanning, lack of equipment, insufficient direction, control, and supervision, are feared and condemned in every department of business and public service, except in that service which has to maintain the public roads in a proper state of cleanliness. Therefore, when the public makes its complaints about the dirty condition of our streets, it is hoped it will remember that sanitary authorities can give improved conditions, provided the public on the one hand is willing to pay for what it asks, and the authorities on the other are willing to expend the money for employing the necessary men and staff to carry out the work.

Notwithstanding the washing and thorough cleansing of the streets in the busiest parts of the Metropolis, and the staff of orderlies engaged in

gathering up the filth during the day, dust is produced in large quantities in dry weather, and dispersed so widely that the air is laden with a mixture of finely powdered manure and other débris from the streets. Indoors the presence of this material is made apparent by its deposition on every surface, out of doors by the suffering produced in eyes, nose, and throat of those exposed to its action. The insanitary and offensive atmosphere produced by this dust tells more severely on persons whose visits to the crowded streets are but occasional, and who live away from the impurities which are here met with; possibly those in daily contact with it are less conscious of its effects, but the nature of the material is obviously so noxious that it cannot be regarded as non-injurious to them. The prevention of dust is without doubt of great importance in every locality, but in a crowded city where, despite all precautions, impurities are largely produced by the countless operations carried on, every care is necessary to render the air as free as possible from solid impurities such as are given off from the streets. The patrolling of the streets during hot dry weather by vehicles, containing water to which a disinfectant has been added, specially adapted for distributing the contents in a fine spray, would probably prevent much of the dust which now causes nuisance; at least it seems worth a trial. Possibly, as the development of motor vehicles advances, a machine may be constructed which, while passing along the street, may, by exhaustion, carry up through a duct, whose lower end travels over the road surface, the dust and dry refuse, and discharge it into a suitable receptacle containing water.

In the outlying districts it is possible to keep down the dust provided a sufficient staff and a sufficiently numerous equipment is provided, but there are certain days when with a high wind and a high temperature ten times the ordinary staff would be needed to keep down the dust which is raised. However, during the last twelve months experiments have been made with a material from which I am hoping very satisfactory results will be obtained, the mixture with the water of a material which it is believed will have the effect of keeping down the dust which would otherwise be raised by the passing traffic.

Another source of impurity in our streets is the too frequent use that is made of them as a dumping ground by the costermonger and itinerant vendor, and by the shopkeeper who sweeps the refuse from his shop into the street, which he seems to regard as a suitable receptacle for the refuse from shops and premises abutting upon it. That is one of the preventable sources of filth and refuse in our streets, and one, I think, which should be dealt with very severely, in order that it may be put down. In that

way much may be done to bring about a better state of cleanliness in the streets of the metropolis, which is undoubtedly very much needed.

Dr. Louis C. Parkes.

THE insanitary condition of the London streets has previously been the subject of discussion at one of our sessional meetings, and there is probably but little that is new to be said on this well-worn theme. The Council of the Institute, however, in its wisdom has thought it appropriate to have yet another debate on the subject, chiefly I presume because it realises that very little has as yet been done to inaugurate that era of street cleanliness in the metropolis which is our desideratum, but of which the attainment appears to be so difficult.

Now firstly as to the health aspects of this question. It may be asked, Is the condition of our streets dangerous or injurious to health? And if so, what are the exact conditions that are dangerous or injurious, and how do they operate? To these questions it may be said at once that there is very little direct evidence that any injury to health is caused by the insanitary condition of London streets, chiefly because out of the multiplicity of conditions favouring or exciting loss of health or actual disease amongst our population it is most difficult, if not impossible, to select a certain agent where so many participate, and to say definitely this is the exciting cause. On the other hand, with the continual advances made in Pathology and in Bacteriology, we are enabled, as time advances, with more and more certainty to select *a priori* certain conditions as being those which from analogy we should consider to be capable of influencing the public health, and although no complete proof is capable of demonstration, we are satisfied to regard these conditions as operative factors.

Bearing in mind then the above limitations, we may say at once that there appear to be two things intimately associated with our London streets that we may reasonably regard *a priori* as influencing adversely the public health. They are dust and mud, different names for essentially the same thing, for whilst dust is dried and powdered mud, mud is merely wetted dust. People say, where does all the mud in the London streets come from? The answer is that 1 lb. of dried dust, containing 30 per cent. of moisture (water), when wetted to contain 90 per cent. of moisture will weigh 7 lbs.; so that, the volume being roughly proportional to the weight, a cubic foot of dry road dust, after rain has fallen, becomes 7 cubic feet of semi-liquid mud. The municipal authorities, who prior to

the rain had only 1 cubic foot of dry dust to remove, after the rain find themselves called upon to remove 7 cubic feet of mud. Hence the enormous economy of keeping the streets as clean as possible when dry, and so avoiding the collection and removal of countless tons of slop.

Now, as we all know, the mud and dust of London streets, especially in the great highways of traffic, is filth; it is largely composed of putrefying organic matter from horse-droppings, with its teeming swarms of putrefactive bacteria. Which is the most dangerous to health, mud or dust? To this we can safely answer, dust. Why? Well, dust attacks our mucous membranes, *i.e.*, the delicate lining membranes of the orifices and passages leading to our internal organs. Mud does not; that is to say, unless the passer-by happens to have a lump of mud splashed into his eye or mouth. Then again, the dry dust of the street not only gets into our nostrils, throats, and possibly into our lungs, but it finds its way into our houses, and, unless we are careful, settles on our food, and by its contained bacteria sets up fermentative changes therein, which render it at times unwholesome, at other times positively dangerous. The irritating decomposing dust of the London main thoroughfares has been credited with causing sore throats (follicular tonsilitis), nasal catarrh, conjunctivitis, pneumonia, and numerous other diseases of the respiratory organs and passages; and it seems at least highly probable that this organic dust, which is so much in evidence in the London streets in such months as March when the wind is dry and boisterous, and which taints the whole atmosphere in the warmer months of the year when rainfall is deficient, is a contributory if not the exciting cause of these and other diseases.

The past year, 1903, supplied an experimental demonstration of the way in which relative absence of dust may conduce to a healthy season and a low death-rate. Last year was one of the healthiest years on record in London, and it was one of the wettest. The general death-rate was only 15·7 per 1,000 per annum, which is 2·8 per 1,000 below the average of the previous five years, whilst the rain fell almost continuously and persistently throughout the spring and summer, especially in the months which are usually the driest and most dusty, reaching a record for the year of 38 inches (Brixton), or 56 per cent. in excess of the average. The consequence of the continual downpours was that the streets were kept flushed and cleansed, accumulations of dust were washed away, and the general atmosphere of London was distinctly purer than is its wont.

From an interesting note in the *British Medical Journal* of January 16th I may quote the following: "One feature of the rainfall of 1903 in

London was the excessive weight of many of the individual falls, or their intensity rather than their duration; for, although the excess was (at Brixton) nearly 6 inches beyond the fall in 1879—hitherto the wettest of the previous thirty-five years—yet the number of days with rain in 1903 was smaller than in six of the past thirty-one years. In the thirty years ending 1900, the number of days with rain was on the average 166, and the average rainfall on each rainy day was 0·147 inches. Last year there were 171 days with rain, and the average fall on each of these days was 0·202 inches, or nearly half as much again as the average. Exceptionally heavy falls of rain (exceeding one inch in twenty-four hours) were nearly seven times as numerous as the average; heavy falls (exceeding half an inch) were nearly twice as numerous; and moderately heavy falls (exceeding a quarter of an inch) were more than half as frequent again as the normal. In London the highest rainfall was that recorded at the Victoria and Albert Museum, Kensington, 42·37 inches; the lowest that at East Ham, 32·29 inches. The exceptionally wet months of the year were June, July, August, and October. February, November, and December were less wet than usual. In June three times the usual volume of rain for the whole month fell in ten days."

In 1903, then, nature very materially supplemented the usual cleansing operations of the London municipalities, with the result that during the wet periods the roads presented a wonderfully clean appearance, and the private drains and public sewers received such a flushing as they have seldom received before. All this was most beneficial for the inhabitants of London, except perhaps for the unfortunate people whose basements were flooded by the storm waters which the sewers were inadequate to convey away.

The lesson of 1903 would appear, then, to be that greater attention should be given to the flushing of our main thoroughfares with water, especially in the warm and dry months of the year. This is especially important in the case of asphalt and wood-paved roadways. On such surfaces the dirt consists of little but horse droppings, which very quickly desiccate, and form a strong and pungent dust, easily raised by the wind. All wood and asphalt streets which are main lines of traffic should be flushed with hose and jet, and subsequently swept, every morning from March to October, unless there has been heavy rain in the night. It is very commonly the practice to sweep the streets when dry, but this is a practice not to be commended, as the operation raises clouds of dust, which settle again, often out of reach of the broom, and the result is not satisfactory. In very busy thoroughfares, where there is much omnibus traffic,

I think that some disinfectant solution should be mixed with the water in the watering carts, not necessarily to disinfect, but to deodorize the dirty wood roadways, and to at least attenuate the odours about which so much complaint is made. Possibly a chlorinated solution, containing a small amount of available chlorine, would be the best for this purpose. If one gallon of "Chloros" (a solution of sodium hypochlorite containing 10 per cent. of available chlorine) is mixed with 1,000 gallons of water for street-watering, a dilute solution containing 0·01 per cent. of available chlorine is obtained. This is probably of strength sufficient to act as a deodorant in the case of wood-paved roads.

Extra flushing and cleansing of the streets means extra cost. There is no available supply of cheap, unfiltered water in London, and nothing has yet been done to draw a supply of water for flushing purposes direct from the Thames in London. The rates are already very high. Is it possible to go to greater expense in this matter? I find that in 1902 in Chelsea the cost of cleansing and scavenging the streets, including watering, was about £14,000. The maintenance and repairs of the public roads, streets, and paths cost another £14,000. Assuming that the whole metropolis spent a proportional amount in accordance with its population, an assumption which probably errs on the side of being under the mark, as Chelsea is a little off the main traffic routes, then the annual cost of scavenging, cleansing, and watering the London streets is about £850,000, and a similar sum is spent annually in maintenance and repair.

If motor-traffic could be made to supersede horse-traction in London it seems probable that the cost of scavenging, cleansing, and watering could be reduced by half, and the cost of maintenance and repairs by a similar amount, a total saving of £850,000 per annum. It is the horses that produce the dust, dirt, and mud, that has to be laboriously collected by hand-labour and carted to the outskirts, or barged away down the Thames. It is the horses' iron-shod feet that tear up the roadways, and render necessary the enormous annual expenditure in maintenance and repair of the streets, and their periodical renewing at short intervals. If there were no horses the slop-water from asphalt and wood-paved streets could be swept straight into the gullies and so to the sewers, and the wear and tear of the street-surfaces would be enormously reduced.

Motor-traffic, then, is a thing that the intelligent Londoner should encourage by every means in his power. It is the only real and lasting solution of the "insanitary street" problem. Enormous additional sums under existing circumstances might be spent in scavenging, cleansing, and watering, but the total result would not be very appreciable in a dry and

hot season. We cannot expect natural causes to aid us every year, as the weather did in 1903, nor is it otherwise a consummation to be wished for.

Probably the best means of accelerating the transition from horse-traction to motor-traction would be (1) the widening of the main lines of traffic, so that vehicles could proceed at a uniformly greater speed than at present. Carriers of goods and passengers in the streets of London will not adopt motor-traction unless it will pay; and motor-traction can only be remunerative if the increased initial cost of the motor vehicle over horse and carriage, and the higher rate of remuneration required for a motor-driver as compared with a horse-driver, are counterbalanced by the ability to make the motor-driven carriage do a proportionately larger amount of work in the same time. This necessarily involves rapid transit and quick journeys, which are only possible if blocks and delays are comparative rarities and not the every-day occurrences they now are. (2) Inasmuch as it is especially desirable that heavy two-horsed vehicles such as omnibuses and drays should be replaced by motor-driven vehicles, as it is essentially the heavy horses and heavy loads that, continually stopping and re-starting, tend to break up the surface of the streets, it would seem desirable that omnibus companies and companies or firms carrying heavy goods should be encouraged to inaugurate motor-traction by a system of municipal subsidies. If over a million and a half sterling is spent annually in London by the ratepayers in scavenging, cleansing, and repairs of the streets, necessitated chiefly by the employment of horses for all classes of traffic, £100,000 annually might be devoted to a system of subsidies, by the aid of which a portion at least of the heavy horse-traffic might be got rid of from the streets, and the cost of cleansing, scavenging, and repairs materially reduced. A beginning once made in this direction, the advantages of motor-traction would soon be generally recognised, and in the course of a few years we might expect to see at least as many motor-vehicles as horse vehicles in the streets.

So far, this short introduction to a discussion has been chiefly in relation to the sins of the horse, the noble quadruped that has so many sins and shortcomings laid on his shoulders. But I cannot conclude without a few words about dogs, man's four-footed companion. In my opinion dogs in London are an unmitigated nuisance. The disgusting condition of the pavements and sidewalks in many parts of London is due to dogs' excreta. Some years ago there were men who made a business of collecting dogs' excreta in the streets and selling it to the tanneries, where it was used in water as a solvent for hides preparatory to tanning. Now I suppose dogs' excreta, or its chemical equivalent, is made in

Germany by a chemical process, and can be put on the market cheaper than the street collector of this choice product can supply it to the tanneries. However that may be, it seems to be nobody's business now to collect the refuse, and even the municipal road sweeper passes it by. There used some years ago, prior to 1891, to be a Police ordinance that householders should clean the footways adjoining their premises. The Public Health London Act abolished all that, and placed the duty of cleaning the footways upon the local authorities. But according to my observation the men employed by the local authorities seldom concern themselves about the sidewalks, and unless the householder cleans the pavement in front of his own house, nobody else troubles to do it. To clean the pavement properly, water is required, but as a rule none is available from a public source; so that to make the local authorities responsible for work, which they have not got the means of properly executing, seems to be an absurdity.

It certainly seems desirable that our borough surveyors should seriously consider as to the best means of cleansing the footways, and so performing a duty which the State has cast upon them. In order also to keep the dog nuisance within bounds, I would suggest that the London County Council apply for Parliamentary powers to put a municipal tax upon dogs in addition to the Imperial tax. A municipal tax of ten shillings per annum per dog would tend to make many dog owners reflect that dogs are not indispensable adjuncts to life in this great city, and the general public would at least feel that those who create the nuisance are to some extent called upon to support the measures necessary for its abatement,

To sum up, then, our conclusions in one sentence. All animals in big towns, except of course man himself, are a nuisance. Let us do our best to get rid of them.

MR. W. WHITAKER, F.R.S. (Croydon) said he was glad that Dr. Parkes had alluded to the wet season of 1903. Everyone thought it was a very bad year. For his part he did not. If there was one thing to which he objected it was dust, and last year was very free from it. He preferred a little rain to a great deal of dust. Now this object-lesson of last year had shown the advantage to the public health of laying the dust; he hoped it would not be forgotten by the local authorities. That lesson had been given without charge, and therefore he was afraid they perhaps might not value it as they should do. No doubt infantile mortality had been reduced because the children last year could not play so much in dusty streets. Undoubtedly it was in the power of our large Corporations to modify the dust-nuisance, or at all events to convert it into a

form that could be easily removed. They all knew what a trouble dust was to the female mind; ladies would go on dusting in the home, but it should be done with damp cloths. To deal with the different degrees of blinding dust in our streets was one of the most important problems that municipalities could devote their minds to. No doubt it would cost something, but we cannot have benefits without paying for them. Indeed we should not object to pay for those conveniences, without which in big cities the people could not live comfortably or healthily. The question was one between paying a certain amount of rates and having a large increase in the death-rate, especially among the younger members of the community, and the gentlemen who had addressed the meeting had properly dealt with every aspect of the problem.

MR. SHIRLEY MURPHY (London) said there were only two points he wished to raise. The first was that the condition that was wanted in the roads of every town was that the surface should be impervious, washed and cleansed. He was told by surveyors in London that the reason we could not have these conditions was a question of cost. Now he had not even seen it stated (and it would be well worth while working out) how much would be saved in the cost of cleansing if a large area of a town were paved with impervious material and washed, as against the cheaper cost of macadam, with the additional cost of scraping up the mud and the removal of the large quantities that collect upon its surface. Probably the balance would be on the side of the greater expense for the impervious material. He did not think the difference would be so great that the inhabitants of a town would not be in favour of the greater expense and the better conditions. Of course, it would be necessary that the area so to be dealt with should be sufficiently large, because now we had the main streets paved with impervious material, but the side streets were macadamised. The mud and dust from the macadamised streets was carried to impervious surfaces of the other streets, and the saving that ought to be effected from the better paving was not now obtainable. If in London they could not have the whole area dealt with by one uniform paving, it would be very desirable that there should be some general agreement between the authorities of the different districts of London as to how the main and important roads should be paved. He had discussed this matter with borough surveyors who had said that with varying local conditions and requirements it is impossible to have anything like a uniform pavement over so large an area as London. There might be a good deal of truth in that, but he had noticed in some cases where a road passed through two different boroughs and where the traffic conditions are identical yet different pavements are used. Making due allowance for difference of opinion as to what is the best thing to be done, that was a difficulty which it ought to be possible to overcome. There ought to be enough experience now to determine how all main roads should be dealt with how all secondary roads should be dealt with, and how the minor streets and courts and alleys should be treated. The necessity for dealing with the poorer

streets, especially market-streets, with some impervious pavement was obvious. Animal and vegetable refuse collected there very easily, and without frequent scavenging at considerable cost became a definite nuisance.

MR. J. P. WADDINGTON (Borough Surveyor of Marylebone) said the main question appeared to him to be one of money. Speaking for his own district, the great difficulty he had to meet was how to get his authority to give him sufficient money to do the work thoroughly. When the estimates for the year were being framed the tendency always was to cut them down, not to give the department any more money for doing the work more efficiently. As to the suggestion to construct suburban roads with tar macadam, he had had some experience of this in the North of England, where he had constructed 3½ miles of this form of carriage-way for a main road between two large towns. Having regard to the cost it wore extremely well, and was certainly more sanitary than an ordinary limestone macadam road. The road was made up of limestone dipped in tar. There was much less dust after the tar macadam was laid. The question of paving for London roads was a very wide one, and one upon which very different opinions are held. Speaking personally, he should be sorry to see all the carriage-ways in London asphalted. He admitted, however, that up to the present time asphalt was by far the most sanitary and easily cleansed material, but it was very cruel for horses, and at times dangerous for riders. Some forms of hard wood paving were also very slippery. For instance, the carriage-way in Oxford Street, by the Marble Arch, was paved with Australian wood and had been down about 4½ years, but the complaints had been very numerous, several accidents had happened through horses slipping when the wood was slightly greasy. But soft wood paving was luxurious and in his opinion worth the money laid out upon it. Now Harley Street, an important thoroughfare, was paved with yellow deal treated with carbolineum. The blocks were immersed in the liquid for some 4 or 5 minutes, allowed to drip, and then laid. He had noticed that during dry weather there was less dust on the carriage-way in Harley Street than was the case in streets immediately adjoining, which were paved with wood coated with liquid tar or cresoting material. But after rain the surface of the road in Harley Street appeared to dry sooner than in the other case. He believed a similar experience had been gained in the City of Westminster. While he thought, therefore, there was a good deal to be said in favour of this material, he was not in agreement with the mode of applying it. He thought it ought to have a longer immersion. The Marylebone Vestry paved a portion of Albany Street, alongside Trinity Church, with deal immersed for 30 minutes, and that was the best bit of deal paving in the metropolis. Owing to readjustment of boundaries that strip was not now in his borough, but while it was under his control, a period of about five years, he did not remember having to effect any repairs, no bad blocks showed up in the whole of the surface, and the same effects were noticeable here as in Harley Street. It seemed to dry

much sooner than the adjoining paving and there was less dust upon its surface in dry weather. He did not agree with Dr. Parkes' suggestion as to the abolition of horses and dogs. Personally he was a lover of animals and he hoped the day was far distant when they would see no dogs or horses in the streets. He would much prefer to have the animals and pay a little more in rates to keep the streets clean. As to washing with water from a hose, now done in several parts of London, he believed this was injurious to both soft and hard wood paving, because the water gets into the interstices, washes out the grout, and the blocks begin to loosen. He preferred the old-fashioned method of washing by a water cart. Before the formation of the City of Westminster, Marylebone had more wood paving than any other district in London, and these roads were washed by means of water carts and squegees. Machine brooms were tried for one or two years, but he had found the work could be done more efficiently and economically by hand labour. Unsatisfactory wood roads he believed were often caused by washing with hose pipes, and therefore his experience suggested the old-fashioned method was the best.

MR. C. H. W. BIGGS (London) confessed to some cynicism in regard to the treatment of this subject by the local authorities. The two papers were a disgrace, not to the gentlemen who had read them, but a disgrace to England, to sanitarians, and to civilization. Here was an expert getting up and saying that we could have sanitary streets if someone would only pay the cost, and this at the beginning of the 20th century. He thought the public did not lose their tempers often enough. We know better than to keep our streets in this state, yet were content to breathe the dust every summer's day. If they could teach the people that this extra expenditure would pay them, then the money would be forthcoming. Would better streets pay the public? Yes, because it was a distinct money value to have men healthy during their working lives. That money value would be found to be more than the extra cost of keeping the streets sanitary and clean. Drive that into the heads of the public and the money would be supplied. This question had been discussed for the last 25 years and the cry was always the same, that the people would not give the money, not for stronger and longer lives, not for means for doing more and better work. If anything could be said that night that would induce people to regard this question differently then a great general benefit would be conferred on the community. With regard to macadam, they would find it impossible to make macadam-streets to wear satisfactorily with heavy traffic; and they could not be kept sanitary. Then the logic of the case was that they should be done away with in such places as London. Tarred macadam was a better material everyone knew, but we do not use it, or if we do use it at all we do not use it to the best advantage. In places like Cromer and Harrogate many miles of roads of this construction would be found bearing a fairly heavy traffic. It wears well and is sanitary. He had long ago advocated motor-traffic, because by its introduction

we should get perfect street surfaces, the contact between the wheels of a motor vehicle would be altogether different in character from the ramming and scraping contact of horses' hoofs. The streets would last longer and the cost would be less. Slipperiness on good surfaced roads had been referred to, and he was of opinion there were two people to deal with this evil, the maker of the streets and the shoer of horses. If the shoesmith will put upon horses the very worst possible form of shoe, then although the maker of the street might be doing his duty the shoesmith was not. If horses were properly shod it would be impossible for them to slip. People who drive valuable horses ought to insist upon their being shod properly. He thought it was disgraceful that at this period of our civilization it should be necessary to have two such papers as those read that evening in order to drum it into the heads of the people to pay money and pay it quickly.

MR. T. LANGSTON (Marylebone), as a maker of roads, bore testimony to the dust and mud-producing qualities of the macadam road. It stood to reason that hard wood must be more slippery than soft wood, and it must also be more noisy. At Nottingham tar-macadam was used in nearly all the streets, and the result was that that city had splendid roads, which stood a great deal of wear, as was proved where it was used on the road to and from the Trent Bridge. Personally he was in favour of asphalt, especially for the coming motor traffic, and there was no reason why it should not be all asphalt in London, fine sand or powdered shell correcting the tendency to slipperiness. Horses were at present shod wrongly, and they could be shod to meet the requirements of asphalt streets, which were sanitary and clean.

THE CHAIRMAN (The Rt. Hon. Lord Monkswell) said that it had given him a great deal of pleasure to be present that evening and to hear the interesting discussion which had taken place. To a great extent he sympathised with Mr. Waddington, who deprecated the suggestion that horses and dogs should be made to disappear from our streets in this great metropolis. Was it to be also suggested that every other animal, including the birds, should follow suit? Then cats had also to be taken into consideration. He had listened with interest to the rather fierce lecture of Mr. Biggs on what might be called the pigheadedness of the public. Someone had referred to the spectre of the "next municipal election." Well, that spectre was before him, and perhaps Mr. Biggs would understand that consequently it was difficult for him to speak his mind, even if he were in entire agreement with what had been advanced in the denouncement of the human race in general. Now, the medical profession was always making wonderful discoveries, and Dr. Parkes had made two discoveries that seemed to be rather remarkable. Last year there were two things that the average Briton used very bad language over, one was the rain and the other was motor-cars. In regard to motor-cars he had his own special grievance, inasmuch

as he was nearly killed in the early autumn in a motor-car accident. He was not therefore quite prepared to give the motor-car that enormous subsidy suggested by Dr. Parkes. The medical profession, however, had discovered in the two things, rain and motor-cars, the greatest possible benefactors to the human race. He might express his general concurrence with the views that had been put forward that evening, viz., that in all probability a considerable increase of expenditure is desirable in the cleansing of the roads and streets. That was not, however, the only direction in which increased expenditure might be desirable.

MR. J. PATTEN BARBER (Islington), in reply, said it was true that year after year they preached the same sermon, and perhaps the whole matter was one which time alone would settle. As his lordship had suggested, education was required. When those who took a broad-minded view, as many did, wanted a better state of things, roads kept in better repair, macadam and other insanitary materials abolished, the dust kept down, refuse kept out of the streets, these reforms would come. Public wants were increasing, and rightly so, but he was afraid general intelligence was not increasing, because there were many persons who were unable to see that they could not get these things at the same cost as the things with which they now had to be content. Half a moment's consideration should convince anyone that if scavenging was to be done three or four times instead of once a great deal more money must be spent. A man must admit that if he wants double what he now has he must pay something like double the cost. This was a matter of education. Happily there were men who were absolutely fearless in spending money on right objects, and who were not afraid of the pains and penalties with which they were threatened when next they asked for the votes of the electors. To his mind there was too great a cry made of reduced rates and reduced expenditure by those who knew it was impossible to obtain these reductions, and why that cry was always raised when elections were approaching he did not understand. Those who had studied London problems must know that the expenditure on all matters relating to public health and convenience in this great city must of necessity increase as the population increased, the amount of traffic increased, and the wear and tear on the roads increased.

DR. L. PARKES (Chelsea), in reply, said it seemed to him there might be a little more efficiency in the work done now. The idea still prevailed among some London municipalities that any class of man was good enough for cleansing the London streets. That was not so. It really paid better to have young and intelligent men to do even work of that sort. Care and intelligence was required to do the work properly, and it paid to have it so done. Cheap labour was a great mistake in most things, and he was sure it was so in municipal sanitation.

DISCUSSION ON

MUNICIPAL REHOUSING.

Opened by W. E. RILEY, F.R.I.B.A.,
Superintending Architect of Metropolitan Buildings, and Architect to the London County Council.

At Sessional Meeting, March 26th, 1904.

ALTHOUGH I am in no way responsible for the subject for the discussion I am honoured in opening to-day, I cannot complain of its want of fertility.

Municipal rehousing is a subject which engages the earnest thoughts of many men, and, as an important part of the broader question of housing the poor, has received on numerous occasions the most sympathetic consideration of H.M. the King and all the leaders of both Church and State. It demands close scrutiny and helpful criticism, so that those, who like myself, are trying to give effective practical assistance in doing the work of this branch of the question, will, I am sure, readily record their appreciation of the selection of the subject. I approach the duty of opening the discussion with diffidence, and the most insistent difficulty is the inability to cover the ground without leaving out essentials, and so divert the consideration of the question into an unprofitable channel. I cannot, however, literally embark upon "Municipal Rehousing" without saying a few words about displacements and the authorities empowered to act.

The Housing of the Working Classes Act of 1890, with the Amendments of 1894, 1900, and 1903, dictate the procedure in regard to insanitary areas.

Part I. provides for clearing extensive insanitary areas and carrying out schemes for improvement in connection with them. For the County of London (excluding the City) the London County Council is the proper authority for proceeding under Part I. The Medical Officer of Health in any district is under obligation whenever he sees cause or upon complaint

as to any area by two Justices of the Peace or twelve or more ratepayers to make a "representation" or official report to the County Council that the area is insanitary, which means: That houses, courts, or alleys therein are unfit for habitation; that the narrowness, closeness, or bad arrangement of streets and houses, the want of light, air, and ventilation, or any other sanitary defects within the area are dangerous, or injurious, to the health of the inhabitants of the buildings on such area or of the neighbouring buildings.

If the area is situated in the County of London (excluding the City), and the Council is satisfied that the representation is justified, it may pass a resolution declaring that the area is unhealthy and that an improvement scheme ought to be made; such scheme must be accompanied by plans and estimates. There is discretion allowed as to including the whole of the property represented. Further, property may also be acquired in order to sufficiently open out the area and provide for suitable sanitary arrangements. Accommodation must be provided for at least as many persons of the working class as will be displaced, and this accommodation must be within the limits of the area or its vicinity. In Clause II. of the Amendment of 1903 this is modified as follows in regard to rehousing under general act other than the Housing Act:—"The Housing scheme shall make provision for the accommodation of such number of persons of the working class as is, in the opinion of the Local Government Board, taking into account all the circumstances, required, but that number shall not exceed the aggregate number of persons of the working class displaced; and in calculating that number the Local Government Board shall take into consideration not only the persons of the working class who are occupying the working-men's dwellings which the undertakers have power to take, but also any persons of the working class who, in the opinion of the Local Government Board, have been displaced within the previous five years in view of the acquisition of land by the undertakers." The Secretary of State has discretion to allow the accommodation to be provided elsewhere and to reduce the rehousing obligations to the extent of one-half, but in November, 1898, the London County Council decided that, in their own operations, they would ask for no relief in regard to the number to be rehoused, and from that date provide accommodation for as many persons as were displaced. The power of the Secretary of State may, by Clause II. of the General Amendment of 1903, be assigned by His Majesty's Order in Council to the Local Government Board.

The scheme must be advertised for three consecutive weeks in a newspaper within the district of the local authority, and a petition accompanied

by a copy of the scheme and other information sent to the confirming authority (*e.g.*, the Home Secretary for Part I. schemes who, if he sees fit, directs a Local Inquiry to be held). If the report of the Inquiry condemns the area, the Secretary of State may issue a provisional order confirming the scheme, and this order must be subsequently confirmed by an Act of Parliament.

Compensation to the owners of the property in the unhealthy area must be assessed in the following manner:—

The estimate of value of lands, or interests concerned, is to be based upon the fair market value at the time of valuation, due regard being had to the condition of, and probable duration of, the buildings in their existing state.

Abatements in value are to be made if the property has been enhanced by being used for illegal purposes or for overcrowding, or if the premises are in a bad state of repair, or if the property cannot reasonably be made fit for habitation.

The receipts arising from a scheme which has been matured are earmarked for what is called a "Dwelling House Improvement Fund." Out of this fund all expenditure has to be defrayed, and the necessary further outlay required for the purpose of the Act may be borrowed on the security of the rates.

Previous to the passing of the Act of 1890, the Metropolitan Board of Works had initiated and carried out clearance schemes under the various Artizans' Dwellings Acts, 1875 to 1882. 21,207 persons were displaced, and accommodation was provided in new dwellings for 27,066 persons, the cleared sites having been sold to dwellings companies and others for this purpose. The Metropolitan Board of Works had also initiated other clearances, displacing 6,188 persons; the completion of these schemes was carried out by the Council, and dwellings erected on the cleared sites under Part I. of that Act to accommodate 2,930 persons. Under Part I. the Council has initiated and carried out, or is proceeding with clearance schemes displacing a total of 14,784 persons, and when all the new dwellings in connection with these schemes have been completed a total accommodation for 14,970 persons will have been provided.

Part II. may be briefly described as a diminutive operation on the lines of Part I.

The Borough Councils as well as the London County Council are empowered to act and the Local Government Board is the confirming authority.

Under this part of the Act the Council has initiated and carried out four schemes displacing 1,855 persons, and accommodation has been provided in completed dwellings for 2,314 persons. The Borough Councils have undertaken schemes involving the displacement of 4,123 persons, and when the new dwellings are completed accommodation will have been provided for about 3,000 persons.

DISPLACEMENTS UNDER SPECIAL ACTS.

Great improvements are carried out by Special Acts of Parliament, but the rehousing obligation in all cases is practically based on the foregoing procedure.

Under Street Improvement Schemes, the Metropolitan Board of Works by the sale of sites to dwellings companies provided accommodation for 10,688 persons.

The Council, under their improvement schemes, completed and in hand, will have displaced 15,257 persons; and on the completion of all the dwellings proposed, accommodation will have been provided for 16,430 persons.

Railway companies and other large corporations, whose operations in any one scheme involve the displacement of 30 or more persons of the working classes, must under Clause 1 of the Schedule of the Amendment Act, 1903, rehouse under the discretion of the Local Government Board. In addition to these cases of displacement, there is an insidious process of destruction of small residential property constantly taking place in the county through private enterprise, and this where there is no obligation, either under the Housing Act or under any special Acts, for those interested to rehouse. In the past three years, building of property which has been brought under the notice of the London County Council has involved the displacement of 6,570 persons, but the proposals did not provide for rehousing more than one-third of that number, and there is no authority charged with seeing that the rehousing proposed is carried out.

These details are quoted in order to show the strong reasons that are continually operating to justify the resolution of the London County Council of November, 1898, to seek no relief in regard to their obligations to rehouse.

OVERCROWDING.

To make clear to your mind what is meant by overcrowding, I ask you to note that it has been laid down in the operations of the London County Council that not less than 400 cubic feet of air space shall be provided

per person in their dwellings (for children under 10 years, 200 cubic feet), and that in any tenement the total number of persons should work out at not more than two to a room, but infants born in the tenements do not count until they attain five years of age, when they are reckoned as half an adult up to the age of ten years.

The last Census Returns (for 1901), giving detailed statistics of the population and houses in London, are full of interesting and useful information in this connexion. The number of persons per room, however, is given irrespective of age.

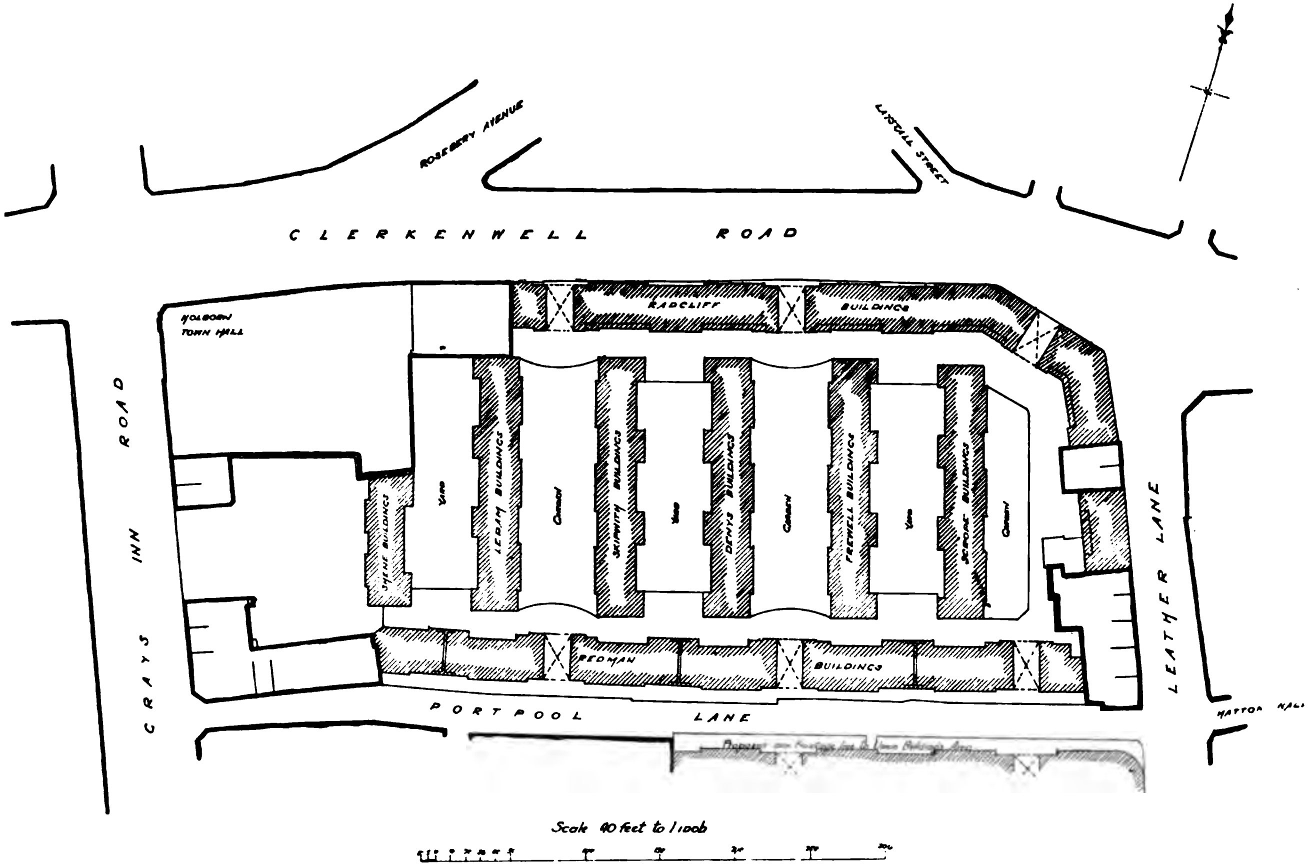
We learn that the population increased during the ten years 1891 to 1901 from 4,228,317 to 4,536,541. Notwithstanding this increase of 308,224 (7·3 per cent.), the number of single-room tenements in which more than two persons were "enumerated" declined from 56,727 to 40,762—a very remarkable decrease, indeed; whilst the number of one-room tenements with six or more inmates fell from 4,097 to 1802. With regard to the one-room tenements occupied by more than two persons, not only do we find a reduction in the number of such tenements, but, more important still, a reduction in the average number of persons occupying those tenements—the number per room in 1901 being 3·62, as against 3·80 in 1891.

Moreover, the number of persons living more than two in a room in tenements of one to four rooms decreased from 831,668 in 1891 to 726,096 in 1901, or from 19·66 per cent. to 16·0 per cent.

Generally speaking, not only the amount, but the intensity, of overcrowding has been reduced, the greatest reduction having taken place in the most significant instance of all—i.e., in the case of one-room tenements, from 172,500 to 149,500 tenements; and, summarising the results under two main heads, it is found that

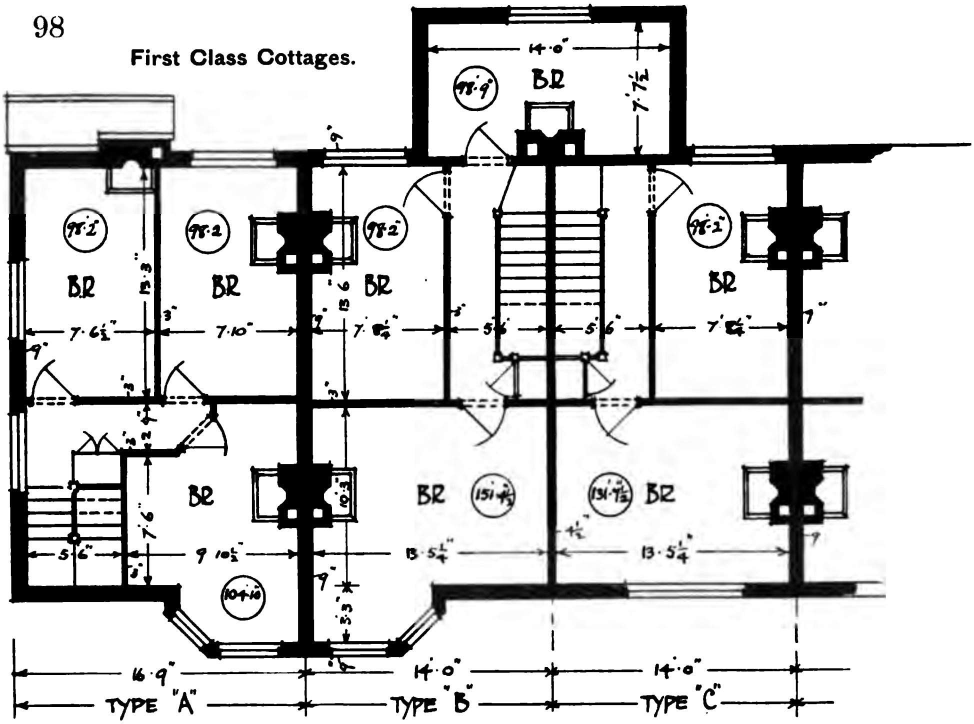
> Tenements of less than five rooms have increased 6·3 per cent., while the population occupying such tenements has only increased 4·7 per cent.;
>
> Tenements of five or more rooms have increased 12·5 per cent., while the population occupying such tenements has increased only 10·4 per cent.

The meaning I attach to "rehousing" is illustrated by a case which came before the magistrate at Bow Street on the 12th July, 1899. A poor woman, occupying a tenement of two rooms on the third floor of Windsor Court was required to vacate her rooms in connection with a clearance scheme. One of the rooms she occupied had an area of 184 square feet, and the other, which could only be regarded as a box-room,

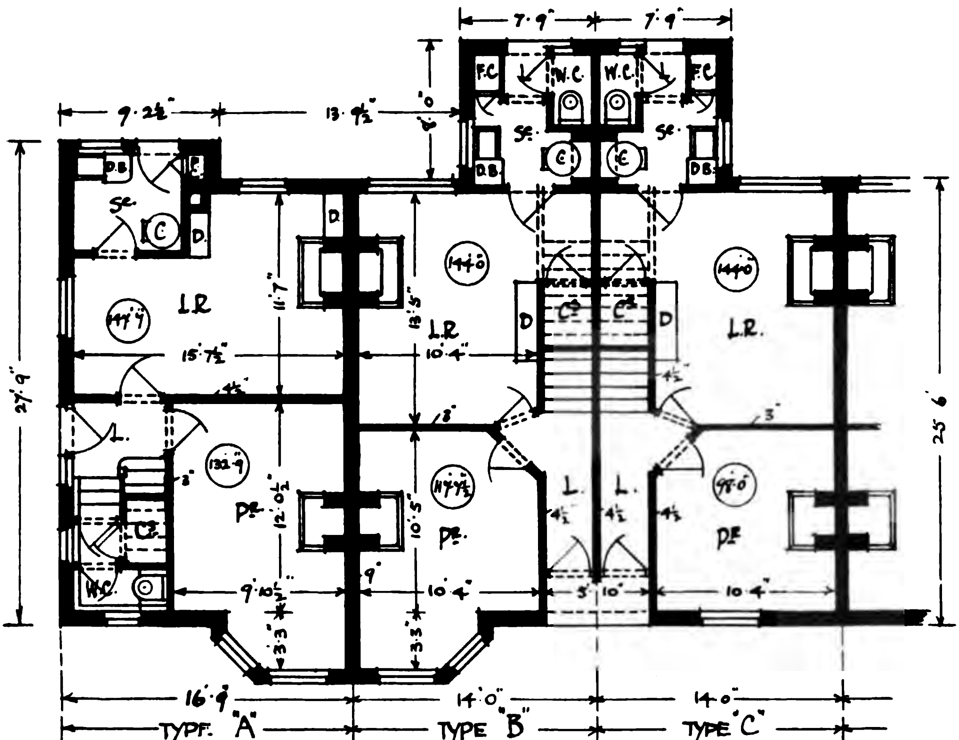


THE BOURNE ESTATE.

London County Council Holborn to Strand Rehousing.



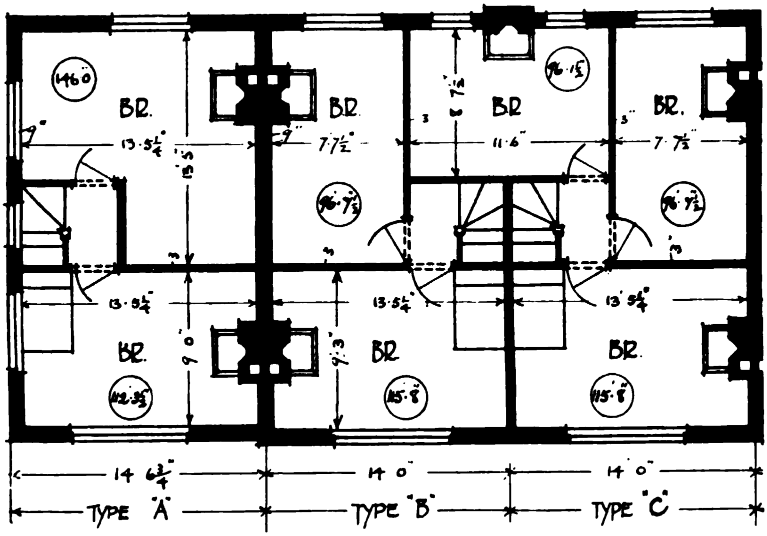
FIRST FLOOR PLAN



GROUND FLOOR PLAN

L.C.C. WHITE HART LANE ESTATE, TOTTENHAM.

Second Class Cottages.



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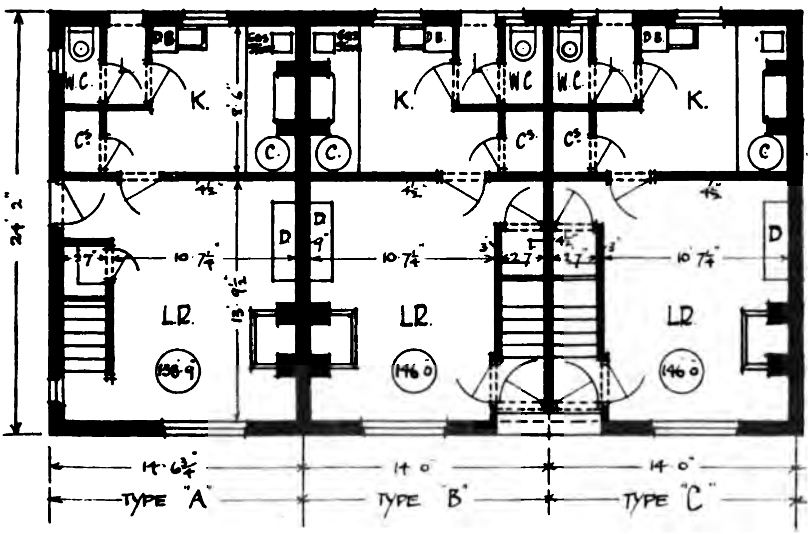
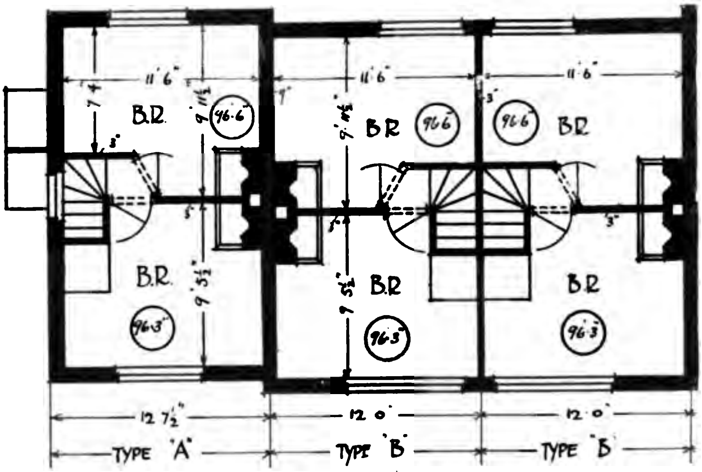


GROUND FLOOR PLAN

L.C.C. WHITE HART LANE ESTATE, TOTTENHAM.

Third Class Cottages.



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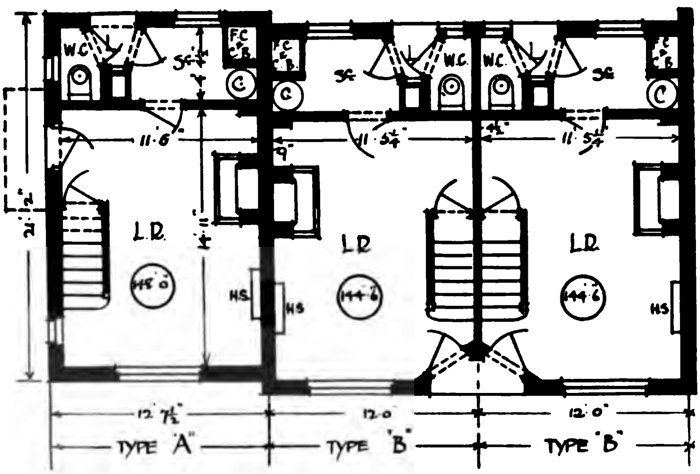


GROUND FLOOR PLAN

L.C.C. WHITE HART LANE ESTATE, TOTTENHAM.

lighted from a well-hole used for storing lumber, was 54 feet super. The sanitary convenience was entirely inadequate, and was common to four tenements. Besides herself the family comprised her husband and four children, and one living away from home. The rent paid was 5s. 6d. per week. As she would not leave, the Council applied for an ejectment order, and she told the magistrate that she could not afford to rent one of the Council's tenements, which was reserved for her at Millbank and would have cost her 8s. 6d. per week. The tenement offered her comprised a living-room, 144 square feet; one bedroom, 120 square feet, and a second bedroom over of 145 square feet; with a scullery and independent sanitary convenience. This accommodation would have allowed the fifth child, the eldest daughter, to live with her parents, which she was unable to do at Windsor Court, and was the minimum standard of accommodation that the Home Office would approve as suitable for such a family. She was paying weekly 2s. 3¾d. for each 100 feet super under the old insanitary conditions, whereas the Council was in a position to rehouse her family in a thoroughly sanitary way without any charge on the rates, at a little over 1s. 10¼d. The magistrate remarked that the rent charged by the Council was too high, and should begin at 6s. per week in order to allow persons so displaced to live at Millbank without much increase of rent. No comment was made on the proportional increase of area required by such a family to conform to the provision of the law, or what charitable authority should provide and pay for the needful additional room for their proper accommodation. The economy in bricks and mortar could not be made, and, therefore, in this case the magistrate's criticism advocated a charge on the rates. He reluctantly allowed the ejectment order, but gave full time for compliance, *i.e.*, 30 days.

This and similar cases appear to need some answer by those who waste their energies in criticising the rent level and the dwellings built by the London County Council. They do not understand that the operations of the Council in this work have necessarily to be conducted on a sound financial basis.

It may be accepted as a broad rule that the price of land and the most economical use of it govern the maturing of any housing scheme in the central districts of London.

It generally costs 15s. to 17s. per foot super to clear slums in central districts, but very few housing schemes can be made to pay if the charge for land alone is more than 5s. per foot.

In bringing the idea home to your minds of the necessity of obtaining some kind of financial support in dealing with this part of the problem,

the handsome donations which started the Peabody Fund and the Guinness and Hales' Trust Funds may be cited as examples which have enabled charitable individuals to initiate vast housing operations which have subsequently been carried on with great benefit to the poor without financial embarrassment.

The price paid by ratepayers for clearing areas and rehousing the poor upon them is an investment which it is presumed repays itself in better sanitary conditions and in the general welfare of the community.

The following particulars relative to the mortality in the Council's dwellings for the year 1903 may be of interest.

The death-rate from all causes was 11·8 per 1,000 living, as compared with 15·2 in London as a whole.

Taken singly the population of the various blocks are not sufficiently large to give reliable results, except, perhaps, Boundary Street Estate, which has a population of between 4,000 and 5,000. At Boundary Street the death-rate works out at 12·7 per 1,000 living, as against a corresponding rate in Bethnal Green of 18·2. It may be noted that the death-rate when the insanitary area was represented was 40·1 per 1,000 living.

Rehousing which has been effected.

The statistics on the question of rehousing the displaced persons in the dwellings built for their accommodation is not on the whole very encouraging.

In 1897 a return was made showing the particulars of the number of persons residing in new dwellings who were displaced or removed from areas cleared by the Council.

Of the 1,210 displaced by the Blackwall Tunnel works, only nine of them took advantage of the new accommodation.

Of the 5,719 displaced in the great Boundary Street clearance scheme, although accommodation had at that time been provided for 1,500 persons, eleven only were living on the area.

There are necessarily rules and regulations enforced in the management of dwellings, and the dislike of the slum inhabitant to any semblance of supervision probably accounts for the fact that so few avail themselves of the new accommodation. As an illustration of this, it may be mentioned that 100 of the families displaced in the initial stages from the Boundary Street Area were fortunate in finding accommodation in the new buildings of the Guinness' Trust just then completed, viz., Columbia Buildings; but I am informed that not one of these families remained in occupation three months afterwards, the reason given to me being that

they would not accept the discipline and control. Returns have been made which bring this interesting portion of the question up to a recent date.

In the Falcon Court scheme, sanctioned by the Local Government Board on the 12th July, 1898, the number of persons displaced was 800, the number for whom new accommodation was provided was 500, and about 40 persons availed themselves of the new accommodation.

A large scheme at Millbank afforded special facilities for rehousing persons whom it was proposed to displace in certain projected improvements, *e.g.*, the Clare Market Scheme, the Westminster Improvement, and the Holborn to Strand Improvement. There are 17 blocks of dwellings providing accommodation for 4,430 persons in 895 tenements, and much of this accommodation was built in advance of the displacement under the various improvement-schemes. On the 7th October, 1902, when all the blocks were completed, 22 of the tenants displaced at Westminster, and 3 from Clare Market, were then in occupation.

A better result was obtained in the rehousing-scheme for the Clare Market and the Holborn to Strand Improvements. It was laid down as a condition of approval that in the immediate vicinity of the improvement accommodation should be provided for 1,000 of the persons displaced. Sites were acquired in Drury Lane and York Street, and great care was exercised to obtain as far as possible the full details of the accommodation required for the various families it was intended to displace, and the plans of the 5 blocks of dwellings which were finally decided upon provided as closely as possible the accommodotion needed. A return was made in October, 1902, showing that the whole of the tenements in Drury Lane had been occupied by persons actually displaced in connection with the improvements. The buildings provided provoked a good deal of adverse criticism, and some effort was made to draw comparison between the rooms vacated by one of the tenants and those which had been provided in the Council's dwellings. Irrespective of the dilapidated and insanitary condition in which the vacated property was found to be, the rent per foot super paid by the tenant was about 4s. 4d. per annum, cheaper in the new dwellings than in those vacated. The cubic space was 8 per cent. more, an independent water-closet, a scullery with boiling-copper and sink, were provided in addition, as against one water-closet and one sink used in the vacated quarters by three tenants. The balance of the accommodation needed was provided at York Street, and I was informed in November of last year that the tenements in those dwellings also, with few exceptions, had been filled by the dishoused persons.

In connection with Rotherhithe Tunnel Scheme, an estate is nearing completion which is intended to accommodate the persons displaced by that work. The dwellings were again provided in part before any displacements were made, but the proportion of persons who availed themselves of the new accommodation was small, and the privilege of offering tenements to other persons about to be displaced in order to forward the work has been granted. The total accommodation which will be provided when the estate is completed will be sufficient for 1,200 persons. The rents are low and the accommodation has been carefully designed in order to meet the wants of those displaced, and it is, therefore, somewhat disappointing to find that numbers of those tenements are still unlet, entailing charges on the Tunnel Scheme.

In the foregoing remarks I have not touched on the very excellent work done by Glasgow, Liverpool, and other provincial towns in connection with Municipal Rehousing. In Glasgow, under the Improvement Act of 1866, powers were given to the Corporation to reconstitute various portions of the city which were insanitary. The powers entailed the obligation of providing accommodation for the working and poorer classes displaced by the erection of suitable dwellings. In 1901 there were 1,500 tenements in blocks accommodating 7,000 persons already erected under the Act of 1866. There is a family-home containing 160 single rooms, each capable of accommodating an adult and three children, and six lodging-houses for men, and one for women, which inclusive of the family-home accommodates about 2,700 lodgers. A new Act was obtained in 1897 entitled "The Glasgow Corporation Improvement and General Powers Act," under which the Corporation were authorised to deal with certain insanitary areas and to acquire additional land not exceeding twenty-five acres within the city or within half a mile of the city-boundaries. This Act entails many of the restrictions of the Housing Act, and will probably be found to hamper the freedom of the earlier housing-operations carried out in Glasgow.

The earlier schemes in Liverpool were carried out under the Liverpool Sanitary Amendment Act passed in 1864. It is claimed that the insanitary property can be acquired more economically than under the Housing of the Working Classes Act of 1890, the local Act being more rapid in procedure. The portions carried out under this Act up to 1901, on the whole, involved a charge on the rates.

It has not been possible in this short time to do more than indicate in outline the general procedure in Muncipal Rehousing. With the increased financial difficulties, the problem of providing suitable accommodation is

becoming more acute in every scheme which is developed. The Amendment Act of 1903 appeared to hold out the hope that the redemption period might be extended to eighty years, but the recent Treasury decision against the extension of the period so far as the cost of erection is concerned has deferred the realisation of that much desired relief for an indefinite time.

MR. E. BOND, M.P. (London) in proposing a vote of thanks to Mr. Riley for his instructive and interesting paper, said that their thanks were specially due to Mr. Riley for the colourless and impartial way in which he had presented the subject to them, without any rhetorical flourishes and without any attempt to make things out to be better or worse than they really were. Only two expressions could he take the slightest exception to: one was as to the "insidious" process going on in the destruction of small residential property through private enterprise. He did not think the word "insidious" should be used, because it seemed to imply something improper in persons dealing with their property if such dealing involves the pulling down of houses inhabited by the poor. The other exception he desired to take was to the concluding remark to the effect that all the housing-companies which have taken part in the reconstruction of London have received assistance in some form or other from more or less charitable action. As far as the Company with which he was connected was concerned, that statement could not be said to be true, except perhaps in regard to one or two sites which in the early days of the Company were acquired from the Metropolitan Board of Works. But there the advantage which the Company gained was precisely the advantage which the London County Council gives to itself. If the Council takes advantage of a scheme under the Artizans' and Labourers' Dwellings Act, as Mr. Riley had very properly pointed out, the general cost of acquiring the site is not charged to the particular housing scheme. The cost of acquiring the site is written down very considerably in order that the site may be brought to what is called housing-value, and the balance of the cost, usually a large sum, is written off as representing sanitary improvements of the Metropolis. To the extent mentioned, his Company had the advantage of obtaining one or two sites acquired by the Metropolitan Board of Works; but he wanted to go beyond that, and to say that his Company had found it equally easy to deal themselves, in an entirely commercial way, with slum-areas. They had in several instances bought slum-areas, had cleared them, and had been able to charge the whole cost of the site against the housing-scheme, and yet were able to make it pay without any loss being inflicted upon the ratepayers or anybody else. He did not say that could be done in all cases, and he did not want to disparage the work done in clearing unhealthy areas. In

some areas that would be impossible owing to the multiplicity of interests, and a considerable sum would have to be paid for removing the great defects which might have grown up through neglect, faulty administration, or bad usage of property in the past. The subject they were asked to discuss was of immense importance and very considerable interest, but it was probably a simpler question in some of its aspects than most of them were accustomed to consider. The question of rehousing or housing (each ran into one another) was really a questión of ordinary economics; it was a question of the relation of means to objects of desire; it was a wages-question—a question of what people can afford to pay for accommodation. There was plenty of accommodation to be had by people who could afford to pay for it, provided in an ordinary commercial way by people to whose interest it is to furnish such accommodation. The real difficulty arises from the fact that there is a large, though he hoped a decreasing, section of the population which is not able to pay for reasonably decent house accommodation. Though on the one hand wages have risen considerably, on the other hand, recently, at all events in London, the cost of providing house-accommodation has risen out of proportion to the rise in wages. His experience was that to erect accommodation for the labouring classes costs a very great deal more, something like 30 or 40 per cent., than it did when his Company commenced operations. That condition was due, not so much to increase in the cost of land, but almost entirely to the rise in wages in the building-trades and to the rise in the price of building-materials, and to some extent also to the greater stringency of the regulations which have been made by the local authorities with the object of securing better buildings and of insuring that such dwellings as are put up shall be more thoroughly sanitary and healthy. That brought him to the point as to whether it is desirable for local bodies, such as the London County Council, to go into the business at all. The reasons given for so doing did not seem to him to be conclusive. The popular argument which was generally relied upon rested on the fact that there was still an immense amount of overcrowding in the Metropolis. It was also realised that there are many slums in which a large proportion of the population lives under discreditable, insanitary, and loathsome conditions, slums that ought to be cleared away and replaced by better dwellings in which some at least of the displaced people can live. Upon that ground largely the housing-policy of the London County Council had commended itself to popular favour. But when they examined into that argument and into the proceedings justified by that argument, they would find that the whole thing is a delusion and a sham. Mr. Riley had given them some interesting particulars as to the extremely small proportion of the people displaced from any given area which is able to occupy, or as a matter of fact does occupy, the dwellings which have been put upon the cleared area. Of course, it was perfectly obvious that people who have been accustomed to pay five or six shillings for their rooms (the utmost they can afford out of their scanty wages) cannot go into dwellings the rents for which are perhaps 7s. 6d. or 8s. 6d. Everyone knows

that a shilling a week in the budget of the families under consideration makes a very appreciable difference; indeed, even sixpence a week makes a great difference, as he had recently occasion to learn. Was it worth while then for the County Council, if it cannot solve the problem, if it cannot provide dwellings which the people turned out of the slums can occupy, to attempt the thing at all? There was no lack of accommodation of the kind required by the aristocracy of the working classes, those who can afford to pay 8s. to 12s. a week for their house-accommodation. Plenty of such accommodation could be got without the County Council intervening. Now the Tottenham estate was one of the most extraordinary departures which the Council had yet taken in this direction. First, the estate was entirely outside the county area. He did not know whether it was proposed to confine the accommodation on that estate to people who worked in London; if that were attempted he thought it would be found to be very difficult to carry out. As a matter of fact, he thought they had been told that in connection with the Totterdown estate at Tooting an appreciable proportion of the population there, were not persons whose work lay in London. If so, then the Tottenham estate became a purely building-speculation. How obviously that was the case was, he thought, shown by the fact that the estate was contiguous or nearly contiguous to another estate known as Noel Park, which belongs to the Artizans' and Labourers' Dwellings Company. To show that the Tottenham estate was not altogether a wise scheme, he thought he was at liberty to say that the Artizans' and Labourers' Dwellings Company have found the Noel Park estate something of a white elephant. They bought a very large tract of land there and built upon it very much the same kind of house that the County Council is putting upon their Tottenham estate, and they very soon found that they had outrun the demand. A large part of the Noel Park estate remains unbuilt upon to this day, and until recently the Company had ceased operations altogether upon that particular property. Well, the County Council, not content to leave that Company to develop the area and provide the sort of accommodation that is required, go into the market, buy this large estate, on which at one time it was contemplated putting down a population of 42,000; that seemed to him a speculation which the Council had no right to enter upon with the ratepayers' money, especially as it was not, as far as he could see, a speculation which was likely to turn out very well from a pecuniary point of view, while the benefit to the persons occupying the dwellings was nil. Mr. Riley said the cottages there had three bedrooms and two living-rooms, with scullery and offices, and were let at 12s. a week. Now that rent was rather an outside rent for cottage-accommodation in the suburbs of London.

MR. RILEY: There are no rates or taxes.

MR. BOND admitted the fact, but said he had himself a few cottages of a similar kind at Wood Green, in the same neighbourhood, and they were let at a

lower rent, which also included rates and taxes. He thought it would be found that the market was well stocked in that particular neighbourhood with houses of that kind, and that the Council would not be able to command so high a rent for their Tottenham houses. At all events, a return of a gross 12s. a week upon the stated cost of such houses did not appear to him to be a very profitable speculation, even if it were the business of the Council to go in for such speculation, which, for his part, he was very unwilling to admit. He thought it was quite clear that accommodation of that kind could be had by any persons who could afford to pay for it. Anybody who went about London with his eyes open could not fail to see North, South, East, and West, whole villages of such houses springing up. It might be that extra amenities would be provided under the County Council scheme, but he was not aware that anything of that kind was yet being seriously attempted. It had been the misfortune of London to be composed of an aggregation of villages. The whole of East London had been constructed in this way; the hamlet of Bethnal Green must, at one time, have presented a similar appearance to the Tottenham estate, except that we have improved somewhat in our cottage-architecture. A sort of new Bethnal Green was being stuck down in the north-east suburbs; it could not be helped, it was the way we do these things and we have to submit, but he did not think it was particularly judicious for a local authority to take upon itself to assist that kind of development more than was necessary, however legitimate it might be to deal with unhealthy areas which could not be acquired in the first instance by private purchase owing to the number and complexity of interests involved. He thought therefore that the legislature, which was not always wise, was wise at the start in laying it down that the acquiring authority, which was then the Metropolitan Board of Works, should not itself build until it had endeavoured to sell the site to an outside body for building-purposes. From that wholesome rule, under various influences, the legislature departed some time since, and had gone the length of passing Acts which enabled the local authority to build speculatively, and of these schemes Mr. Riley had given them some account. He thought it was difficult to say that this kind of work did anything towards solving the problem which they were all anxious to solve, a problem which he did not think was capable of solution by any one drastic remedy, the problem of providing that everybody should have wages or income enough to enable them to live wholesome and decent lives. If that came about at all, it must come about by the operation of economic forces and by a general desire not only on the part of those who want to solve the problem, but also on the part of those who are immediately interested in the question—the people who have to earn their livelihood by the labour of their hands or brains, and those who employ them. He did not pretend that he had himself any solution to offer, but he did say that if they were going to employ public money for rehousing purposes they ought to make the strongest endeavour to provide, without throwing any burden on the rates, dwellings that people who now live in

the slums woulld be able to afford to live in. This was rendered difficult by the fact that a public body did not like to put up dwellings which will not stand the closest possible scrutiny, both with regard to method of construction and appearance. In Drury Lane he understood an effort had been made in that direction. He had not seen them, but he understood hostile criticism was directed at them because of the scantiness and shabbiness of the accommodation there provided. Well, that criticism had to be faced, and if they were to do any good with these schemes undertaken at the public expense they must submit to such criticism if they were to render more tolerable the lives of those people turned out of the slums. People did not altogether live in the slums because they liked the slums, but mostly because the houses were cheap, or cheaper than houses they could get elsewhere, and also partly because they were sometimes convenient for work. The only way to help those people was to clear away the slums and put in their place houses of an unpretentious kind, not four or five-roomed tenements, but one and two-roomed tenements which can be let without throwing a burden on the rates at a rent which the displaced persons can afford to pay. He thought that a great deal could be done by the plan which Miss Octavia Hill had popularised, viz., the plan of taking over blocks or streets of old dwellings, and sending down to them as rent collectors men and women of kindly nature, who would take an interest not only in the collection of rent but in the lives of those who pay the rents. In this way a great deal could be done towards civilizing the least civilized areas in London. In this connection he would like to draw attention to an article by Miss Alice Lewis which appeared in the *Economic Review* of April, 1900, giving experience of a most interesting kind of such work as that he had indicated. Miss Lewis told how she had reclaimed one of the worst slums in this manner, a slum which had defied police attention for years. Having quoted at length from this article, which ended with the statement that in this whilom den of thieves the tenants came to leave their doors unlocked and the rent on the table for the collector while they went on errands, Mr. Bond concluded by again thanking Mr. Riley for his interesting paper.

MR. ALDERMAN THOMPSON (Richmond) said, as one who held the opinion that any activity in the direction of providing sanitary dwellings for the people should receive every encouragement rather than any discouragement from those interested in sanitary matters, it filled him with dismay when he heard the suggestion made by Mr. Bond that they should not take an active part as sanitary authorities in the prime necessity of providing better sanitary conditions by means of healthy dwellings for the people. Mr. Bond's suggestion seemed to be that there is plenty of accommodation for people who can afford to pay. That suggestion contained a fallacy. There was not plenty of accommodation for those who can afford to pay; the ordinary artizan earning good wages and with a family cannot find, at the rent which he can afford to pay, proper and suitable accommodation in or near London. He wanted to make perfectly clear

the view that he took, and the view that the working classes took. Having been closely in touch with them, he could say the view they take was that private enterprise had not built a sufficient number of new dwellings, and had not in such new dwellings provided suitable accommodation for the workmen and their families, let alone for the unskilled labourer. All round London, a few miles out, they would find very few decent cottages for working men, or houses suitable for occupation by the working classes. Directly any decent dwellings were provided, or when there was a clearance, as at Boundary Street and elsewhere, there was a tremendous pressure on the part of the working classes to obtain the accommodation. Yet great masses of respectable artizans live under unhealthy conditions. In an area not far from that place, not a slum-area, there were children of some 200 families attending an average Board school, and 80 per cent. of those families were living in two rooms, in those block-tenement houses which are to be met with in the middle zone of London, with insanitary conveniences, and not any separate entrance from the street, with four or five families in one house, and paying a rent of something like 6s. 6d. to 8s. 6d. for the two rooms. But the matter went beyond even that; persons in receipt of incomes from £100 to £250 a year could not get satisfactory accommodation. They could go round to the suburbs and see rows of bay-windowed houses provided for persons earning £300 or £400 a year, but let out to two or three families, although without proper sanitary conveniences for so many occupants. They were streets of whited sepulchres. How could it be said that private enterprise met the difficulty when it had not provided the right type of house? It therefore became the duty of some authority to step in and provide the type of dwelling more suitable to the needs of the working classes. If private enterprise would do it there was no need for municipal action. Mr. Bond said that he did not think it was desirable that local authorities should do this work. But it was not a question of being desirable or undesirable, it was a case of necessity. Without the strong action on the part of the London County Council they would not have seen the marked reduction in the one and two-room tenements. This was a point lost sight of by those who criticised the action of the Council, the fact that there had been a slow, steady improvement in the condition of the masses of the people. Now the practical question was, what were they going to do and what could be done in regard to this great question? First of all, he was glad to think there was a tendency on the part of nearly all local authorities to abandon the system of block-dwellings. He had been very pleased to hear Mr. Riley's remarks on the subject. There was objection to block-dwellings on all grounds; they cost twice as much to build, and the sanitary results were worse. The death-rate in block-dwellings was always higher. Recently he had taken the trouble to investigate this aspect of the question, and in dwellings owned by various companies in London he had found that the death-rate was 30 per cent. higher than the average death-rate of the County of Surrey, which had all kinds of dwellings mixed up together, including slums.

MR. BOND: The death-rate in the dwellings I am connected with is 12·7 per 1,000.

MR. THOMPSON: Yes, but probably only for one particular year or so, and without the usual percentage of children and others more susceptible to disease and death. He urged that those living on the ground-floor of dwellings vitiated the air breathed by those living in the upper storeys. Air-space was reduced, sunlight excluded, and a generally lowered vitality resulted. This was proved by the experience of large towns like Glasgow or Paris, where block-dwellings were numerous. He contended that as a rule the highest death-rate would be found in those towns where there was the largest number of families crowded on to a given space. This piling of people one upon the other was not only objectionable on sanitary grounds, but also because it was the most expensive form of housing. In the central districts of London the difficulty of rehousing displaced tenants in or near the vicinity of a condemned area should not be met by building these tall and costly blocks, but should be overcome by the admirable plan many times suggested by Dr. Sykes, viz., that of purchasing existing middle-class areas in the vicinity of slums, adapting them for the occupation of three or more families, and providing the proper sanitary conveniences. The Glasgow Workmen's Dwellings Company did this in a very satisfactory manner in one or two schemes which have been tried, and found it paid them one per cent. better than building new dwellings. That was a practical suggestion which ought to be given a trial by borough councils. He did not believe in buying slum-property; slum-property ought to be condemned like any other rubbishy stock, such as bad meat. He believed that Dr. Sykes's plan could be advantageously put into operation in several places, Kensington, for instance, where whole streets could be purchased without inflicting any injustice upon the persons displaced; persons who would be only too glad to get out into the suburbs with a reasonable allowance for their expenses. Proceeding to deal with housing-effort at Richmond, Mr. Thompson said that Richmond was responsible for the first scheme under Part III., the first as distinguished from rehousing. A row of 132 cottages was erected, and the highest rent for six rooms and scullery was 8s. per week, and the average rent for the bulk of the six-roomed houses was 7s. 9d., and some were let at 7s. 6d. These cottages had paid remarkably well, there being an accumulated fund of three or four thousand pounds, and £500 a year was contributed in relief of rates. The advantages to these tenants in the way of health could be proved by instances coming under his own observation, and there were the indirect advantages of the bread-winner not being laid by periodically. The people gained more in self-respect, and the benefit to the community was consequently obvious. The great point was to have dwellings of a suitable type, with low rents; here the rent was 8s. against the 12s. charged by the County Council.

MR. RILEY: Our rents go down to 7s.

Mr. Thompson said the Richmond rents went down to 4s. 6d. for two rooms and a scullery, and in every case there was a large garden. In their case the land cost twice as much as the land at Tottenham, and yet a profit was made upon the scheme. The whole difference (and there Mr. Bond touched the spot to a great extent) was the increased cost of building, and that increase was more serious than many people imagined. The cost of building was responsible for nearly half the rent. Out of 7s. 6d. paid in rent for a six-roomed cottage the interest on the cost of building came to 3s. per week; the interest on the site, gardens, and construction of roads and sewers was only 8d. per week; so that no less than 3s. represented the cost of building as against 8d. for the land; the cost of roads and sewers would work out at something like £1,200 per acre. Thus the increased cost of building was a serious factor. He thought that was due to preventible causes, and largely due also to the stringent regulations of the Local Government Board and the over-insistence of certain sanitary faddists. Some municipal buildings he had seen were erected more like fortresses than cottages: solidity and substantial structure had been carried to excess; they were too well built. It was a good fault, of course, but in view of prevailing conditions, open to objection. The Richmond cottages were good enough for all practical purposes, and were better built than a good many private villas; they were built to last for 100 years and cost very little to keep in repair. In other cottages built by the municipality he had noticed several things; for instance, great chunks of concrete separating the roofs. That did not add to the beauty, and was certainly an unnecessary expense. Of course, this expense was due to the regulations of the Local Government Board and to the provisions of the London Building Act, which requires that the party-wall shall be carried through the roof. It was supposed to be a protection against fire, but in cottage property the risk of fire was extremely small, and in that type of house it was unnecessary to incur that extra expense. Then there was another absurd condition: the construction of the third bedroom of a workman's cottage by means of a back addition, which meant an enormous expense. Over and over again they had tried to get the Local Government Board to allow a 9-inch wall to carry an attic. There was no real objection so long as the height was not carried up too far. Any practical builder or architect would endorse this view. But no! the Local Government Board said that if there was an attic-floor the wall must be half as thick again, adding 50 per cent. to the cost of the brick work. But he did not want to go into every detail, though many points in connection with the building of workmen's dwellings could be considered with advantage. He did not agree with Mr. Bond that the increased cost of labour was such a serious factor. He had taken Laxton's Price Book and had found there had been nothing like the increase in wages as had been suggested. The increase was more in the cost of the articles used. Mr. Thompson then proceeded to give the figures, showing the advances in cost of labour and materials, respectively, between 1894 and 1900 in connection with the Richmond

cottages. He urged the importance of modifying the specifications in certain points so long as sanitary points were not affected, and added that as there was a paramount necessity for providing sanitary accommodation for the working classes, all these things would have to be duly considered. He hoped that the County Council would be encouraged to go on with its work, but he hoped the type of dwelling would be reconsidered, lowering not the standard of sanitation or comfort, but to some extent the standard of building-construction. He believed it was possible for the County Council to put up houses with six rooms for much less than £395.

MR. RILEY said the smallest County Council cottage cost £204.

MR. THOMPSON said he believed even that cost could be reduced by the adoption of a less rigid style. This was not the fault of the permanent officials, but of the powers that be, who laid it down that everything must be done according to rule, which by no means made better and more sanitary dwellings, but which ran up the cost and consequently increased the rents. Fewer fads, less precision on various points, and more elasticity would enable cottages to be erected more cheaply. He believed that operations are much hampered by the establishment of a repairs-fund. His experience proved that such a fund is unnecessary, and imposes a burden upon the tenants far more than the circumstances justify or require, while a simpler style of building would enable local authorities to more easily meet the housing-needs of to-day.

DR. J. F. J. SYKES (St. Pancras) observed that Mr. Riley had not made it quite clear that rehousing a population of an insanitary area and getting the people into the new houses put up was a very different thing from getting a population into new houses built for a street-improvement. The two populations were of a different class altogether. In the case of a street-improvement, the population of the houses destroyed would probably go into the new buildings, but in the case of the destruction of an insanitary area, the slum-population, each family perhaps existing in a separate room, about the lowest type of population, would not go into the houses built for them, and they could not be compelled. Then there was another point in connection with the Bourne estate: it was not so much a displacement as an improvement, a large brewery-site being occupied by the new buildings. That was to the credit of the Council in helping to send outside London an industry which could be carried on in the country quite as well. That point had not been touched upon in the debate. He would have liked Mr. Riley to enter into the question of the relative merits of internal arrangements of dwellings; this was an important matter, and it was one upon which some of the speakers seemed to have differed. Companies had an advantage over municipalities: they could pick and choose their sites. But the municipality had really no choice of sites; the area had to be dealt with as best it

could; a company could refuse a site. He did not advance that as an argument against the company, but mentioned it as a point of difference between the two methods. Then there was another question: private enterprise had built many good dwellings, but private enterprise had also built execrable dwellings; there was no supervision of construction; the Building Acts did not touch internal construction or arrangement of dwellings. The great danger to London was the wholesale construction of flats with bad internal arrangements, and there was no provision of the law to meet this danger. It was a serious point. Then again, the municipality did not build down (he used the word advisedly) to the class of people whom they dishoused. He sincerely hoped they never would; that would be neither progressive nor moderate, but retrogressive. He did not wish to go into the question of the payment of rentals, but from the sanitary point of view he thought municipal authorities ought to put up dwellings which would bear comparison with any other dwellings of the same class. It did not pay builders to put up small houses, and the result was that large houses were erected, and not being let to tenants of the class for which they were originally intended were sublet. This was where the mischief came in. Such houses would be let out in parts without having their internal arrangements designed for such occupation. Several families would occupy them, and with one bad occupier the house would soon be ruined, and a few such houses would ruin a neighbourhood. This showed the great difference between municipal and private enterprise. If private builders would provide houses of the type which were being built by the municipal authorities, he had no doubt they would be able to compete, because it was a well-known fact that a private individual can do things very much cheaper than a public authority. It was to be remembered that the ordinary house could be as tall as the flat, and if that house was sublet, then just the same result occurred as in a flat, so far as foul air rising up was concerned. Therefore to substitute flats for houses could not be a greater injury. He did not object so much to blocks or flats; what he objected to was subletting houses whose internal arrangements were not designed for sublet occupancy. Perhaps in a ten-roomed house there would be only sanitary and domestic conveniences for one family. This question of internal arrangement had been entirely overlooked by the legislature, and something would have to be done or a serious condition of things would arise from this packing of people closer and closer together in existing houses without adaptation. In his opinion this was a point upon which very great emphasis should be laid.

Mr. C. J. Hair (Southampton) desired to bring forward one practical point as illustrated by what had been done in Southampton, where pretty well everything had been tried in dealing with this problem. Cottages did not pay because enough of them could not be got upon the site. He thought the real solution lay in the double tenement-house: one cottage on the ground-floor, and one on the floor above, going no higher than an ordinary cottage. By this means one-

half the number of party-walls were saved, and other considerable economies were effected. In Southampton they proposed to build sixty-six of these cottages at a cost of £160 a cottage. These three-roomed cottages were the cheapest thing that could be done. The site was in the centre of the town in a slum-area cleared seven years back. He was glad to hear the statistics showing that overcrowding in London was decreasing; that was surely a proof that the buildings provided by the London County Council were wanted. If municipal bodies could not afford to house the poor people was it likely that private enterprise would make the attempt? There was little doubt that the undesirable portion of the community could not afford to pay such rent as would give a return for the money expended. If, however, they tried to house the better working classes, giving better conditions, there would be fewer undesirables in the future. The children would grow up better citizens and be able to pay for better dwellings. In the country the difficulty was that the schemes were small; the bigger a scheme the better chance there was of its paying. One present drawback seemed to him, that Councillors were losing interest in the question of the housing of the working classes. They started well, but finding the difficulties to be encountered they lost heart, and the committee had a thankless task in trying to get a scheme through without the sympathy of the Council.

DISINFECTING STATIONS.

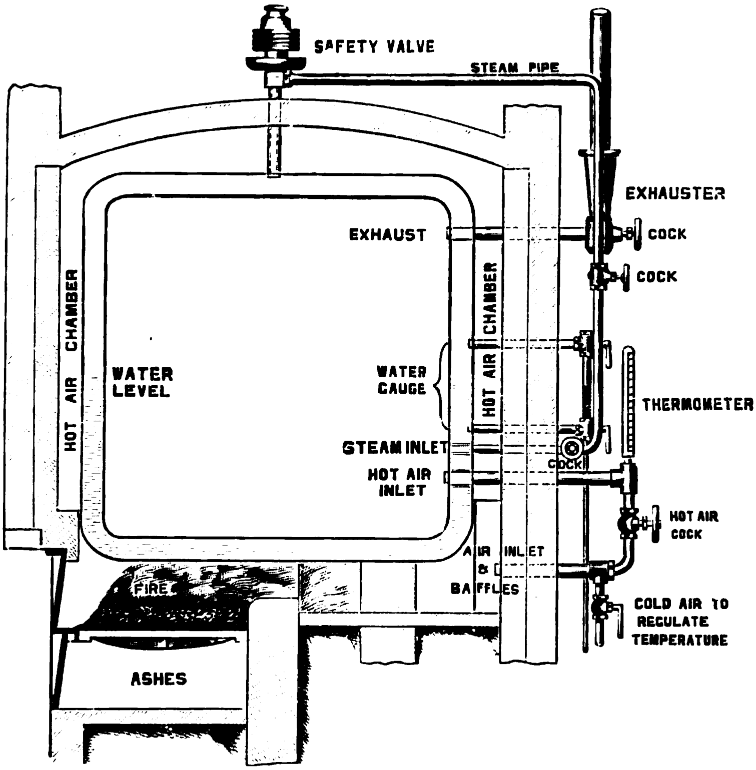
By HENRY R. KENWOOD, M.B., D.P.H.,
Professor of Public Health, University College, London, and Medical Officer of Health for Stoke Newington.
(FELLOW.)

And P. J. WILKINSON, F.R.C.S.E., D.P.H.
(MEMBER.)

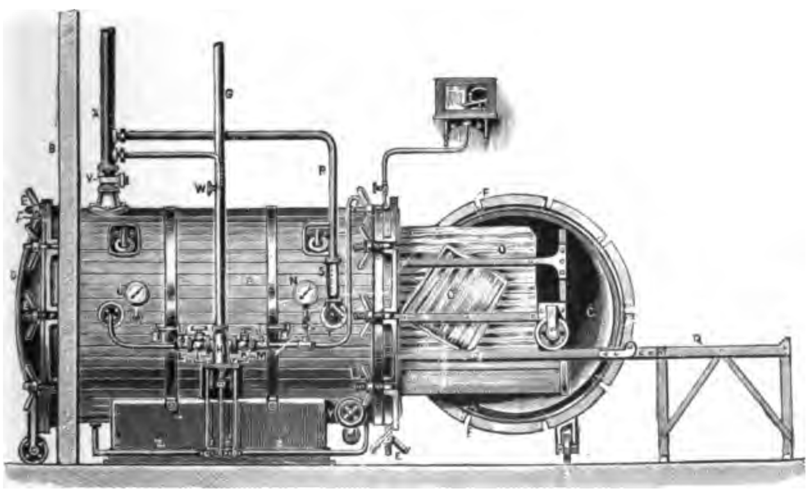
IT is now well recognised that the disinfection of textile articles can be effected by the use of steam, more quickly, more certainly, and with less damage to the article disinfected than by the use of any other agent. It is not judged necessary, therefore, in this paper, to give the experiments of Koch, Wolfhügel, Gaffky, Loeffler and others which prove these facts; but the several ways in which steam has been employed for disinfecting purposes demand some consideration.

As steam penetrates into the interstices of a cold body, it undergoes condensation, and imparts its latent heat instantaneously to the cold objects in contact with it. When thus condensed into water it occupies only a very small fraction (about $\frac{1}{1600}$) of its former volume. To fill the partial vacuum thus formed more steam presses forward, in its turn becoming condensed and yielding up its latent heat, and so on until the whole mass has been penetrated.

The steam used for disinfecting textile articles should be saturated steam, for the disinfecting value of superheated steam is but little greater than that of hot air, since its penetrating powers are but little superior. Saturated steam is water vapour at a temperature very slightly above that at which it has been generated, and therefore in such a state that it will condense at once upon any article but slightly colder than itself; and the abstraction of the smallest possible amount of heat causes condensation of a portion of the vapour corresponding in quantity to the heat abstracted. If saturated steam is further heated a few degrees, the vapour becomes superheated and thereby partakes more of the physical characters of a gas,

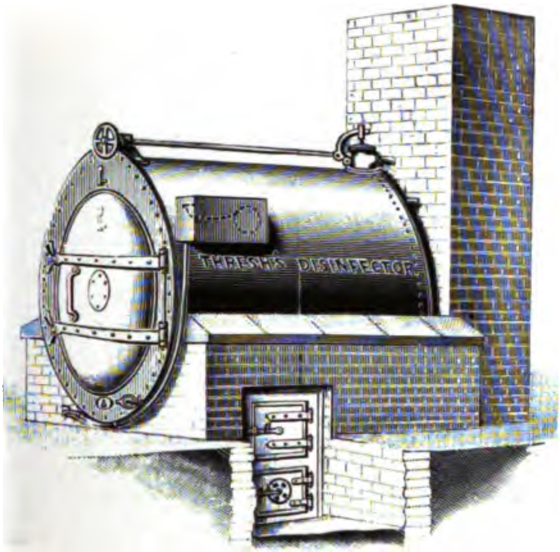


Goddard, Massey and Warner's Disinfector.

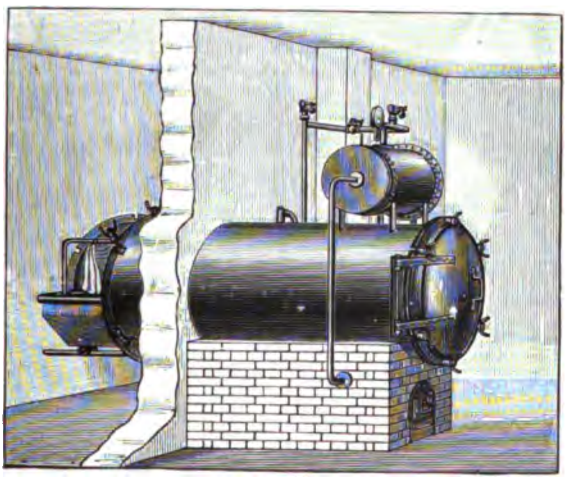


The Equifex Disinfector.

Disinfected articles being removed from the oven at the Chelsea Disinfecting Station.
(The vacuum-producing apparatus is seen on the left of the oven.)



Thresh's Disinfector.

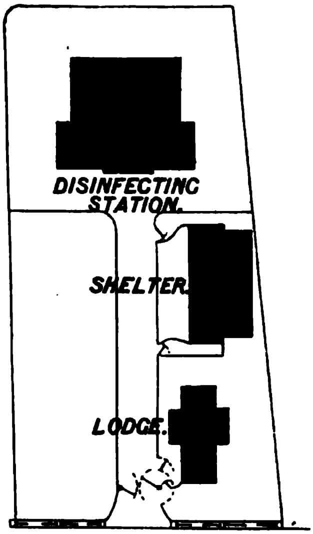


Reck Disinfector.

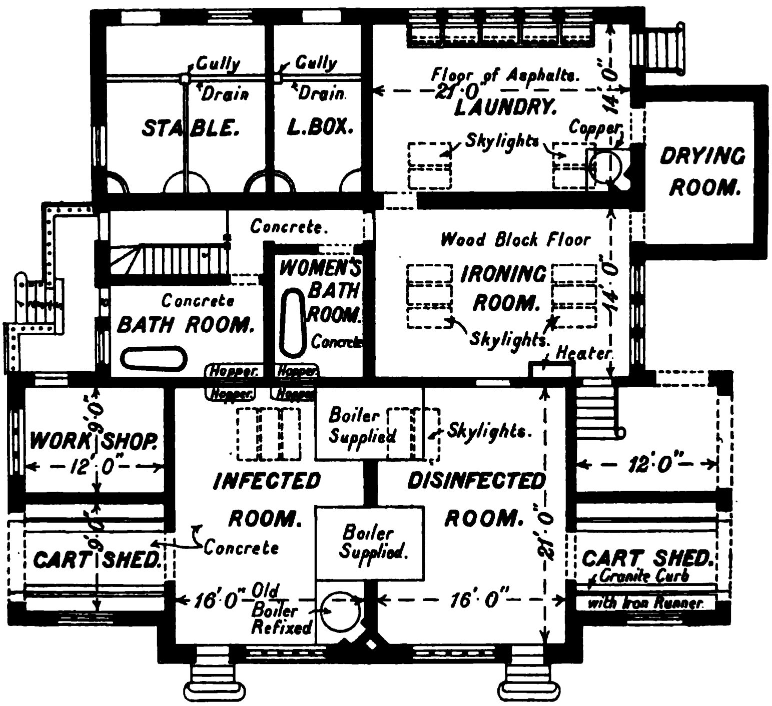
The Rotary Sterilising and Washing Machine.
(Manlove, Alliott & Co.)

Small one-cell Destructor at the Disinfecting Station of the Borough of Chelsea.
(Manlove, Alliott & Co.)

BOROUGH OF HACKNEY.

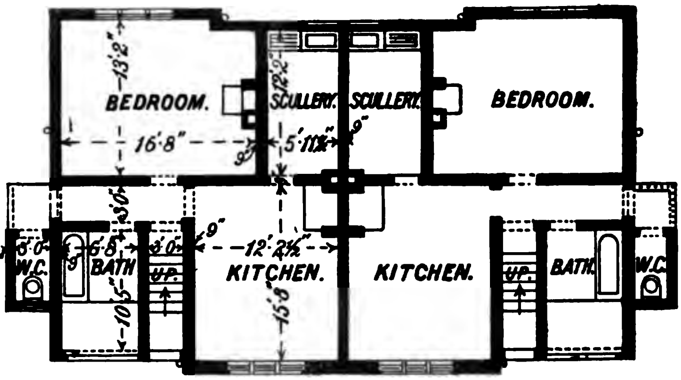


General Plan.

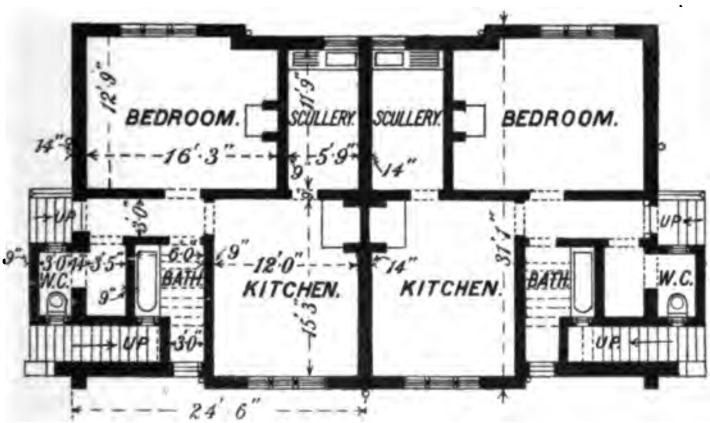


Plan of Disinfecting Station

BOROUGH OF HACKNEY.



First Floor of Shelter.



Ground Floor of Shelter.

The Shelters and Disinfecting Station of the Borough of Hackney.

View of a part of the Borough of Fulham Disinfecting Station—showing infected van, the entrance to infected van shed (on left), the exterior of stable, and the top cabin lights.

Interior of the Laundry at the Borough of Fulham Disinfecting Station, showing rotary washer, hydro-extractor, and door of a drying oven on the extreme right.

Interior of non-infected chamber (showing the two ovens) at the Fulham Disinfecting Station.

Interior of Infected chamber at the Borough of Fulham Disinfecting Station.

in that it can only be condensed to the liquid form with difficulty. When therefore it is borne in mind that the rapidity and completeness of the penetration of steam into a bulky textile article is almost entirely dependent upon condensation, the advantages of the use of saturated steam are at once apparent.

The use of superheated steam involves a longer exposure in the chamber, and thereby a greater expenditure of fuel, in addition to an increased liability to injure articles. The amount of "superheat," however, which is generally given to the steam in practice is not sufficient to cause it to act very differently from saturated steam.

Saturated steam may be used as current steam at about atmospheric pressure. This steam, under the ordinary conditions of use for disinfecting purposes, is slightly supersaturated; that is to say the vapour contains particles of water in suspension which are the result of the condensation of a portion of the steam itself. Doubtless apparatus using such steam are efficient disinfectors. Professor Delépine testifies to the fact that he has invariably been able to destroy anthrax spores from various sources in less than one minute when a rapid current of steam (free from air) is made to pass over them. The spores of Bacillus Anthracis are generally taken as a standard of the most resistant bacteria capable of infecting man, and there is no reason for believing that the thermal death-point of any human contagion is a higher one, although certain spores, such as, for instance, those of some bacilli found in cultivated soil, are far more resistant.

Steam generated at a pressure of 10 lbs., and therefore at a temperature of 115° C., will generally sterilize soil in a quarter of an hour, but steam at atmospheric pressure, and therefore at a temperature of about 100° C., requires much more prolonged exposure in order to achieve the same results (Esmarch). Hence there is an advantage, in point of time, in the employment of steam-disinfecting apparatus in which the saturated steam is used under pressure, and the higher temperatures are thereby obtained, when very highly resistant organisms have to be destroyed.

If any form of steam-disinfection of bulky textile articles is to be efficient, is is most important that all air should be removed from the apparatus and from the interstices of the article to be disinfected. Gruber's experiments demonstrated (what might well have been surmised on physical grounds) that the destruction of micro-organisms and the rate of heat penetration of a mixture of air and steam, presented no advantages over hot air of a similar temperature. In the presence of air, micro-organisms will certainly survive temperatures which will damage textile articles.

The importance, therefore, of expelling air has led to the adoption of various measures designed to effect this object. Thus, in certain apparatus using steam confined under pressure, the steam is allowed to escape from time to time, as this promotes rapid penetration; the sudden reduction of the pressure causes an expansion of the steam in the interstices of the material under treatment, and vaporization of the moisture contained therein, which displaces the air (otherwise often compressed) in the centre of bulky articles. The greatest effect is of course produced when the steam has been under high pressure. In others a partial vacuum can be created by suitable apparatus after the introduction into the chamber of the article to be disinfected; and Prof. Delépine has demonstrated that when a sufficiently large outlet is provided, the object can be readily effected by the passage of an abundant current of saturated steam through a chamber. The current steam drives out and carries away the air; but doubtless high-pressure steam can be made to effect this with somewhat greater rapidity.

Since saturated steam penetrates largely by reason of its condensation upon the textile articles it disinfects, it necessarily renders them somewhat damp; but if steam is super-saturated it leads to excessive wetting, which, while offering no advantages *qua* disinfection, may cause colours to run and increase the difficulties of subsequent drying. There is no such running of colours when saturated steam is employed, and any apparatus which wets the goods is of an imperfect type.

As to the pressure at which the steam should be employed in high-pressure saturated steam-apparatus in order to get satisfactory results in the shortest time, experimental data are few and somewhat conflicting. A pressure of 10lbs. (temperature 115° C.) is certainly sufficient for all practical purposes, although, as would be expected, there is evidence that a pressure of some 20lbs. is slightly more expeditious in its work.

The time required for disinfection by steam obviously depends on the resistance of the organism to be destroyed, the bulk of the infected articles, and the pressure of the steam employed. The best researches indicate a temperature of 115° to 120° C. for twenty minutes, as trustworthy in all cases.

Doubtless pathogenic bacteria can be sufficiently rapidly killed for all practical purposes by a rapid current of saturated steam at current pressure; and since such apparatus are cheaper, of simpler construction, and easier to work, they will often be preferred. For smaller installations, in which relatively little work has to be done and where an unskilled individual is asked to perform it, they are to be recommended.

The size and shape of disinfecting ovens are made to suit all requirements. Generally speaking, it is a mistake to fix an oven of less dimensions than from 6 ft. 6 in. to 7 ft. in length and from 4 ft. 6 in. to 5 ft. in height. The oval or elliptical and the rectangular shapes are most frequently adopted, although it would appear that the circular form is the best from a mechanical or structural point of view. Articles, such as mattresses, pack best in the rectangular shape.

Usually the body of the machine alone is jacketed, and the doors are properly lagged with non-conducting material. Under these circumstances there is no trouble from steam-condensation upon the door; but some makers steam-jacket the doors as well.

The rapidity of the penetration of heat into articles is ascertained by placing within them a thermometer which on registering the required temperature rings a bell, by reason of the mercury completing the circuit of an electric current from a battery. The efficiency of the provision for drying the articles is gauged by the amount of moisture remaining in them after removal from the stove, as calculated by the increase in weight of the article. The maximum temperature reached in the stove and the uniform distribution of the heat may be tested by means of recently standardised maximum thermometers wrapped up in blankets and exposed in the stove; and the pressure within the stove can be ascertained at any time by the pressure-gauge.

There are three methods of supplying the steam to the oven:

(1) The steam may be conducted from an existing boiler working at a convenient distance. This is a cheap method, and it possesses the further advantage that the process of disinfection can be put into operation without any loss of time at any hour of the day.

(2) The steam may be generated in a small special boiler. Such a boiler is sometimes made to supply steam for washing-purposes.

(3) The lower part of the jacket of the oven may be filled with water, and by firing directly under the machine, steam may be raised in the jacket of the disinfector itself. This arrangement favours compactness and economy, but a separate boiler is more accessible for cleansing and repairs.

Where the water supply is hard there is a great advantage in making arrangements for softening the water before it is allowed to enter the boiler; more especially is this of importance when laundry work is done upon the premises, and when an apparatus is used in which the jacket of the oven is made to serve as the boiler.

The various stoves now employed for disinfecting by steam may be classified as follows :—

1. Stoves in which steam without pressure is employed. These are of course cheaper, but, generally speaking, those upon the market are less efficient than—

2. Those in which steam at low pressure (2, 3, or 5 pounds per square inch) is used. Although the temperature of 110° C., which can be reached by some of these stoves, is generally sufficient, a higher temperature can never be employed in them. These stoves, though cheaper, meet with less acceptance in this country than—

3. Those in which steam at high pressure (10 lbs. and over) can be employed. A temperature of 115° C. to 120° C. can be obtained in these stoves; and an exposure of articles for about twenty minutes will suffice for their disinfection.

We will now proceed to a brief description of the forms of stoves mostly used in this country at the present day. In the high-pressure *steam disinfector of Messrs. Goddard, Massey & Warner*, of Nottingham (p. 117), the oven is rectangular, with steam-jacketed doors, and the lower part of the jacket of the oven serves as the boiler. There is also a chamber for heating air, and by means of an exhauster a strong current of hot air can be made to pass through the oven. By means of this hot air the articles are warmed prior to the admission of steam, and after disinfection the current of hot air is made to carry away the steam and to dry the articles.

The method of working the apparatus is as follows :—A fire is lighted and the closet filled with the articles to be disinfected. The doors are closed and screwed up, making a perfectly steam-tight joint. In the meantime steam has risen to 20 lbs. pressure per square inch on the boiler, blowing off at the dead weight safety valve. This latter is of such a size that the steam cannot rise above 20lbs. pressure, thus preventing any damage which could occur through inattention. The exhauster is now set to work by opening the valve and steam supply, causing a current of hot air to pass through the valve into the closet, thus thoroughly warming the articles.

After this operation has continued for some little time the valves are closed. The steam is then admitted to the closet by another valve, and in about two minutes the pressures in the closet and boiler are the same, as shown on the gauges. The pressure is then increased until it blows off at the safety valve. The articles are left in the closet for twenty minutes. Then the valve is closed and the valve to the exhauster opened; this

operation allows the steam in the closet to escape, the pressure soon falling to zero. The valves are again opened and hot air passed through the closet, displacing any steam in it which would condense on the articles when the door is opened, and also thoroughly drying the articles that have been disinfected. In a few minutes the door may be opened, the valves closed, and the disinfected articles taken out on the opposite side of the apparatus to which they are put in. The stove can also be supplied with a separate detached boiler if this is preferred.

Messrs. Goddard, Massey & Warner are also the licensees and manufacturers of Washington Lyon's steam disinfector, which is oval in shape, has a separate detached boiler and a non-jacketed door, and in which the steam in the oven is slightly superheated by the greater heat of the steam in the jacket.

The high-pressure *steam disinfector of Messrs. Manlove, Alliott & Co.*, of Nottingham (p. 118). This disinfector, made under the patents of Mr. Washington Lyon, is a steam-jacketed chamber, and the steam in the jacket is employed at a pressure and temperature distinctly higher than that employed in the chamber itself. The steam is thus somewhat superheated. The air is removed from the chamber and from the interstices of the articles by means of a vacuum-producing apparatus or air-pump, which is also utilised to produce a current of hot air through the oven after disinfection, and thus to remove the steam and dry the articles disinfected. The use of steam for heating the entering current of air ensures a necessary control of temperature, since the temperature of the air cannot at any time be raised above that of the steam.

On exhausting the chamber the reduction in pressure from steam at 20 lbs. per square inch above atmospheric pressure to a pressure considerably below that of the atmosphere, is accompanied by a corresponding fall in the temperature at which water changes into vapour, with the result that any moisture or dew which may have been either introduced with the articles to be disinfected or condensed from the steam used for disinfection, is at once evaporated by the heat stored both in the particles of moisture and in the substance of the goods. This action in itself is practically sufficient to ensure dryness.

The machine can, when desired, be used as a simple hot air oven heated by steam, but without any steam in the disinfecting chamber, and it may be used in this way for disinfecting furs, leather, and other animal substances that may be injured by the application of steam. The use of the vacuum favours the rapid penetration of the hot air and the disinfection of the articles in a short time.

The *Equifex Saturated Steam Disinfector* (p. 117) is worked with saturated steam at 10 lbs. pressure (115° C.). The chamber is non-jacketed, and its walls are lagged with non-conducting composition and wood. The doors are provided with runner wheels and floor rails to facilitate opening and closing, and an internal wheeled carriage for the clothing, etc., runs on internal rails and hinged outside rails. An ingenious automatic recording gauge with a diagram-card on a clockwork revolving drum is provided with the disinfector. The card is marked by a pen actuated by the variations of pressure which, owing to the steam being saturated, corresponds to and accurately indicates temperature in accordance with Regnault's law.

Condensation upon the walls of the cylinder is prevented by an arrangement of coils containing steam at high pressure; and the articles are subsequently dried by hot air. By admitting steam first of all to the coils the chamber is warmed before the infected articles are introduced, then valve T is opened and steam admitted to the chamber by valve I. When the thermometer S registers 96° C., close valve T, and, the air being then ejected, the pressure will rapidly rise to 10 lbs. (115° C.), which will be registered on the automatic recording gauge. At the end of five minutes close valve I, open valve V, and close so soon as pressure on gauge U has fallen nearly to zero, thus re-evaporating the moisture condensed on the objects, and ejecting with the steam any air remaining in the pores of the articles. Repeat this discharge of steam at the end of the second and third intervals of five minutes, thus giving a total exposure of fifteen minutes net to saturated steam at 10 lbs. pressure. In the last case open also valves W and Y, thus allowing air to be sucked in over steam-heated pipes, and to carry off the last traces of moisture. An ordinary mattress will be dried in from five to twelve minutes, and thicker objects with corresponding rapidity.

Thresh's Disinfector (p. 119).—In this apparatus steam without pressure at a temperature of about 106° C. is employed, the superheat being obtained by using in the boiler a calcium chloride solution, the boiling point of which is considerably above that of water. The lower part of the jacket of the cylinder contains the saline solution, and acts as the boiler, which is heated by a small furnace, and the steam which enters the chamber escapes continuously through a chimney. As the water of the boiling solution evaporates, an equivalent amount is introduced automatically from a small cistern with a ball-valve arrangement. When the steam has passed for a sufficient length of time the raising of a lever cuts off all communication with the inner chamber, and the steam escapes directly

into the open air. Then, upon opening the aperture below the door of the inner chamber, air is drawn through a coil of tubes surrounded by the boiling liquid, becomes heated, traverses the inner chamber, displaces the steam, and dries the articles contained therein. It is claimed that at the expiration of an hour from the commencement of the operation, the bedding, etc., may be removed, as disinfection is then complete, and that the articles will be found to be as dry as when introduced.

Where a steam boiler already exists for other purposes the steam from it can be used for heating purposes; this is done by passing the pressure steam from the boiler through a coil fitted in the jacket, in which is the solution to be heated. The apparatus is of simple construction and easy to work, and it is one of the cheapest upon the market.

Reck's Apparatus (p. 119) is a cylinder three feet in diameter and seven feet long, with the following special features: (*a*) the use of low pressure steam at 104° C. to 106° C. delivered to the apparatus by an automatic regulator at a rate which cannot be exceeded, (*b*) the absence of any steam jacket, and (*c*) an arrangement by which a cold water shower can be turned into the chamber, with the object of removing all steam from the interior in the shortest possible time after the process of disinfection is completed. As regards the cold shower, it is introduced at the top of the apparatus and falls on to an umbrella-plate spread over the upper part of the hot chamber, and which distributes the stream over a large surface and conducts the water to the floor of the chamber, where it escapes in such a manner that it does not come in contact with the articles which are being disinfected. The result of the sudden introduction of the cold shower is a rapid cooling and condensation of all live steam in the chamber, the vacuum produced being automatically replaced by air entering through a valve in front of the apparatus as fast as the steam is condensed and carried away by the cold water.

The steam goes through the disinfector into an opening in its top and the exhaust outlet is in the bottom. The current of steam is not interrupted when the air has been expelled, but is allowed to go on the whole time, thus gradually removing all traces of air from the interstices of the articles.

The arrangements for drying consists in a simple water jacket that surrounds most parts of the disinfector. During the steaming process the water in the jacket is heated to the same temperature as the interior. When the process of disinfection is completed, air is allowed to pass through the disinfector, and the water jacket gives off heat enough for drying the articles completely before they are taken out.

The disinfectors are for ordinary work built for 1½ pounds pressure, but they can be supplied if desired for use with a higher pressure, and capable of completing the disinfecting process in a still shorter time.

The cost of the different apparatus above described varies of course with the size, and as to whether the steam used is pressure steam or not. The apparatus employing steam under pressure differ very little as to cost; those with chambers from 6 ft. 6 in. to 7 ft. long and of a height of from 4 ft. 6 in. to 5 ft. cost from £260 to £270, exclusive of the cost of setting; but Thresh's apparatus for current steam, and Reck's apparatus of similar dimensions, may be purchased for half these amounts.

A disinfecting station should comprise:

1. Two rooms completely separated from each other by a wall into which the stove is built so that it communicates with both rooms. The infected articles are brought into one room and placed in the stove, and after disinfection they are removed from the other end of the stove, which opens into the non-infected room. No infectious material must be allowed to enter the non-infected room, and there should be no direct means of communication between it and the infected room. The floors and walls of both rooms should be made of some smooth and non-porous material, which can be readily and efficiently cleansed by water; and exceptionally good provision should be made for ventilation and light. If good ventilation is not provided the rooms become very hot in the summer time, and it is a good plan, in order to reduce the heat and to protect the articles from dust and smoke, to arrange that the stoke-hole and coal-store are outside the compartments when the furnace is immediately under the disinfecting oven, and even when the boiler is separate the stoke-hole and coal-store should be placed in a small compartment, shut off from the working rooms.

2. An incinerator and destructor, provided with a small second fire to cremate the products of imperfect combustion before they pass up the flue.

3. Separate sheds for (*a*) vans employed to bring in infected articles, and (*b*) those employed to return the disinfected articles.

4. A laundry and bathroom should also form part of a disinfecting station, and a charge may be made for any laundry work undertaken after the disinfection of infected articles.

The Disinfecting Station proper.—The walls should be lined with glazed brick or tiles, carefully jointed, or with some other hard, smooth, and non-porous material; and there should be as few angles as possible to harbour dirt. The floors should be laid in concrete, grouted over to a

smooth surface with cement, and with ample provision for drainage. The rooms for infected and disinfected articles, respectively, should be so arranged that direct communication is impossible, and the doors of these rooms should be placed at the extreme ends of the building.

The *Rotary Sterilizing and Washing Machine of Manlove & Alliott* (p. 120), is designed to meet the difficulty that has been experienced in most hospitals and kindred institutions, in dealing with linen that has been soiled by one or more of the many forms of animal matter.

It is a matter of common knowledge that such soiling will often be fixed by the ordinary methods of washing in a laundry. Moreover, such washing is sometimes preceded by steeping in a disinfecting fluid which leads to much objectionable handling. In the rotary sterilizer, such articles can be thoroughly cleaned and disinfected by saturated steam with a minimum of handling and without leaving any stains. As the sterilizer is composed entirely of metal, there is no chance of the vessel becoming foul and odorous; and its construction is such that disinfection may be effected by saturated steam at 112° C. It is fitted with two doors and built into a cross wall, so that purified and disinfected goods may be discharged from the machine after treatment into a separate room, where there is no chance of their coming into contact with infected and untreated articles. As some of the liquor discharged from the sterilizer might be of a highly-infectious nature, the precaution is taken of boiling it in a separate vessel prior to allowing it to escape into the drains.

The Illustration is from a photograph taken on the infected side.

The mode of driving the sterilizer is, of course, quite optional. In the installation illustrated, electricity was preferred, and the little driving motor may be seen on the right side of the picture.

Staff.—The disinfecting staff should always be provided with overalls, and caps or handkerchiefs for the head. An ideal arrangement would be for the worker on the infected side to entirely change his clothes in an adjoining room before commencing work, and a bath should be taken before leaving the premises.

The person in charge of a disinfecting station must always bear in mind that certain materials are injured by steam disinfection. Flannel and woollen goods may shrink somewhat and become discoloured unless a suitable steam disinfecting apparatus is properly worked; but kid and leather articles are shrunk so much that they are spoiled, and feathers and furs are rendered hard and dry. Books, moreover, must not be placed in such an apparatus.

It is necessary, therefore, to make some special provision for separately

disinfecting the articles which are injured by steam disinfection. For books, we know of no better provision than an air-tight cabinet, provided with a tightly-fitting door, and with a cubical capacity of some 100 cubic feet. The cabinet is provided with wire shelves on which the books may rest. The books are so arranged that their leaves open out fanwise, so that when a lamp (placed on the floor of the compartment) is made to generate some 2 per cent. of formic aldehyde into the atmosphere of the cabinet, the disinfecting vapour can get between the pages. Fortunately, books have little tendency to retain infection, and the above method has proved quite efficient after many years of practice.

Leather-goods, furs, and feathers are often treated in the oven by means of hot air, steam being excluded. This method cannot, however, be relied upon to disinfect, and a preferable means is to spray them copiously with either 1-in-500 perchloride of mercury solution or with 2 per cent. formic aldehyde solution, to allow the articles to dry slowly, and then to respray them.

Collection and delivery of articles.—Separate vans should be used for the infected and clean articles, and these should have distinctive colorings; as by picking out with red the infected van, and the van delivering the clean load with white. They should be zinc-lined, and constructed internally so as easily to be cleaned. Such vans cost from £50 to £60 each. The vanmen should have books with duplicate lists of the articles removed, which list should be initialed by the owner on collection and after delivery.

The system of collecting the smaller articles in canvas bags, which can be put direct into the oven, is generally adopted. By this arrangement, the risk of articles belonging to different premises being mixed at the station is almost removed, but separate parcels must always be made of articles which are damaged by steam disinfection. It is a good plan to place coloured fabrics in bags separate from the white articles; and if each article is carefully folded up and packed in the bag, the articles are not so badly creased as is otherwise often the case.

Laundry.—To many modern installations laundries are attached, and it is a distinct advantage in minimizing the risk of infection. As steam or electric power is always available the machines may be driven by either. There should be a rotary washer, hydro-extractor, washing troughs, rinsing and blueing troughs, all supplied with steam or hot water. In addition ironing and sorting tables, mangler, drying ovens, etc., should be provided.

The laundry is also serviceable for the use of the shelter, when this provision is also made, as it commonly is, in the immediate neighbourhood of the disinfecting station.

Shelters.—The need of shelter accommodation for persons who are compelled to vacate their houses whilst the premises are being disinifected is far greater than might be supposed from the use generally made of this provision. The Public Health (London) Act, 1891 (section 60, sub-section 4), enacts that: "The Sanitary Authority shall provide, free of charge, temporary shelter or house accommodation, with any necessary attendants, for the members of any family in which any dangerous infectious disease has appeared, and who have been compelled to leave their dwellings for the purpose of enabling such dwellings to be disinfected by the Sanitary Authority."

The shelter should be made as pleasant and cheerful as possible in order to meet the prejudice which persons entertain against entering it. It should contain a large bedroom, containing one large bedstead and a second smaller one, kitchen, scullery, w.c., and bathroom for each family accommodated; and a sufficient supply of bedding, cooking utensils, crockery, etc., should be provided. Usually a fixed sum of money is allowed per occupant per day in cases where they are too poor to purchase their own food.

Destructor.—It is so frequently found necessary to destroy infected articles that for this purpose a suitable destructor is essential in connection with every disinfecting station. In several of the Boroughs of London (Hackney, Fulham, &c.) the refuse-destructors are close to the disinfecting station so that infected articles to be destroyed can be dealt with there. If, however, the destructor is at a distance, suitably constructed receptacles may be used for the conveyance of infected material.

In connection with the Chelsea Disinfecting Station, there is a small *one cell* destructor (Sergeant's patent) constructed by Messrs. Manlove and Alliott (p. 121). It works efficiently, and at a very small cost, and is found sufficient for the needs of the Borough. Similar destructors are also made by several other firms.

Messrs. Goddard, Massey & Warner, of Nottingham, make a combined apparatus for burning infected rubbish and for disinfecting articles. In this apparatus the heated products from the combustion of the burning refuse are made to assist the process of the disinfection of textile articles by steam.

The construction of the combined furnace and steam disinfector, in accordance with this invention, has a flue passing out of the furnace and carried forward into a brick chamber which is constructed to partly surround the steam disinfector, by this means the heat contained in the products of combustion from the refuse is brought to bear upon the outside

shell of the steam disinfector, thus utilizing the heat by generating steam and also forming a warm jacket to the disinfector.

When the refuse is not sufficient to produce all the steam and heat needed for disinfection ordinary fuel may be fed upon the fire grate. The steam produced may also be used to sterilize excrementitious matter or sewage from infectious hospitals.

The position of the station will often, for various reasons, leave something to be desired, but in selecting the best available site due regard should be paid to accessibility from all parts of the district served, and to the sufficiency of the area as to size.

As to the total cost of a properly equipped disinfecting station, exclusive of shelters and the cost of the land, and designed to do the work for a population of 100,000, the amount will generally fall between £3,000 and £4,000, and the annual working expenses will not fall short of £1,000.

One of the most recent and best equipped installations in the metropolis is that of the Hackney Borough Council, regarding which we give the following notes:—Erected in 1901, site over three acres. *The Station* (see plans, pp. 122–124) occupies an area of about 4,000 square feet, including laundry, cart sheds, workshop, stables, bathroom, &c.

The rooms receiving the infected articles and the disinfected articles are each 16 × 21 × 18 feet; walls white glazed bricks; floors concrete; top cabin lights which open for ventilation; electric lighting. Infected and disinfected rooms quite separated, entrances being thirty feet apart. Dividing wall has glass windows.

Contains two Manlove & Alliott full-size machines, fitted with vacuum apparatus, sorting tables and racks.

The sheds for the infected and non-infected vans have entrances to the infected and non-infected rooms respectively, and are placed at the extreme ends of the building. For the purpose of cleansing of verminous persons, and dealing with clothing worn by verminous persons, two *hoppers*, with locking arrangements on either side, are constructed in the wall of the infected room. There are separate bathrooms for women and men, and the verminous clothing is passed through the hoppers to the infected room, where it is introduced into the oven.

All articles are collected and returned in separate bundles. Printed lists of articles given on receipt and delivery.

Staff: One foreman disinfector and assistant, two vanmen.

Vans: Zinc-lined, and infected van picked out in red, disinfected van picked out in white. Disinfectors wear overalls and take a bath before leaving work.

Laundry: 28×22×18 feet, contains 1 washing machine; 1 mangler; 1 hydro-extractor; a drying-room; washing and bluing troughs, made of glazed stoneware; ironing tables, with irons heated by electricity.

Machinery is driven by electricity.

Stables are provided for two horses for the vans, together with a loose box for a sick horse.

Shelters (see plan), very handsomely constructed in red brick; consist of four tenements. Each has a large bedroom, kitchen, scullery, bathroom, and w.c., and is well furnished and equipped. In 1903, 159 persons were accommodated for varying periods.

The total cost of land (3 acres), buildings, and all apparatus was about £10,000.

Views of the Disinfecting Station for the Borough of Fulham are given on pages 125–128.

HYGIENE IN SCHOOLS.

By F. BUSHNELL, M.D., D.P.H.
Pathologist, S. Devon and E. Cornwall Hospital, Plymouth.

SIR JOHN SIMON'S ideal education would "by model and example lead the poorer classes of society to know cleanliness from dirt, . . . and would apply their instincts of self-preservation to the deliberate avoidance of disease."

Charles Kingsley believed that "teaching of this kind ought to and will be held a necessary element in the school course of every child, just as necessary as reading, writing, and arithmetic." To this most of us would say, "Yes, and even more necessary."

The first question to be answered is: "What are the opportunities afforded in elementary schools for instruction in practical hygiene?"

In 1900 the "block grant" system was introduced into the annual code of the Ministry of Education. All schools must take certain subjects, including "Lessons on Common Things," with a list of additional subjects, one or more of which must be taken when H.M Inspector thinks it is desirable. In this list are hygiene, animal physiology, domestic economy, elementary physics, and chemistry. Besides this, special grants are paid for cookery, laundry-work, dairy-work, and household-management. The instruction in all subjects is to be in accordance with a syllabus which must be produced to the Inspector at his visit. Under Article 16 any other subject may be introduced if approved by the Inspector. In 1889, of five and a half million boys, girls, and infants on the rolls, 2 per cent. were taking domestic economy (mainly girls) and 1 per cent. (mainly boys) animal physiology. This, I think, shows the ample opportunities that exist and the slight advantage that is taken of instruction in hygiene. However, the Leicester and Bradford School Boards and Dr. Hall at the Leeds Schools have carried out with success a scheme of hygiene-teaching, and in the West of England some action has ensued.

The second question that arises is: "What powers exist to supervise and improve the health of scholars and the conditions under which their school life is spent?"

The Department of Education has confined itself in its codes mainly to regulations intended to ensure the physical well-being of children; it has drawn up building-rules (which are often disregarded, I understand); it

has authorised restrictions to exclude children or to close schools during epidemics; it has also issued a model course of physical training, and such training has been definitely approved by the Prime Minister. The Local Government Board issues a memorandum on epidemic sickness; it and the code of rules of the Medical Officers of Schools Association should be familiar to all teachers. Separate schools for children of imperfect intellect have been provided, and special grants are paid to their maintenance. An important step in advance is the appointment in some places of medical officers to the schools of education-authorities. Dr. Kerr's first report to the London School Board, June, 1903, and the excellent observations made on the pupils of the King Alfred School, Ellerdale Road, Hampstead, are worth perusal. The weights and measurements of children, the supply of adequate food, cleanliness of person, soundness of teeth, freedom from disease of the nose, ears, eyes, throat, skin, etc., can thus be observed and dealt with systematically. Such statistics would soon be a record of very great value of the national physical conditions.

The third question of import is: "What inducements are held out to teachers to train themselves and impart such knowledge as we advocate to children?"

It is obvious that, granted even the full approval of the Education Authority, it is indispensable that the lecturer be animated by absolute conviction of the truth and relative worth of such knowledge, which, as the late Mr. Herbert Spencer truly said, is the most momentous question in deciding on a code of education.

Teachers are regarded as fully qualified after passing the certificate examination, either as acting teachers or after residence or attendance at a Training College. The syllabus for the 1903 examination for acting teachers (who continue their work in schools while reading for their examinations) included under "school method" certain points in school-hygiene of the utmost importance. However, no knowledge of the elements of animal physiology is asked for. Training Colleges have the power of drawing up their own schemes of study, and undoubtedly should insist on such instruction in their curriculum. This may be given in the evening continuation classes under "Knowledge of common things," and "Life and duties of a citizen." As you may know, the British Association appointed a Committee in 1902 to report "on the conditions of health essential to the carrying on of the work of instruction in schools." This Committee advised that the Education Department should (1) "adopt or recognise some more thorough and practical test of a teacher's knowledge and experience of the application of health conditions in school

life"; and (2) should further "protect health in school life by making practical knowledge of hygiene as applied to school life an essential qualification for those to whom it entrusts its school inspection."

Finally we should determine what we consider as all important for embodiment in our national systems of education. Before doing so I may here remind you what health conditions the British Association considered imperative in school life:—

(1) Bodily nourishment;
(2) Clothing;
(3) Housing of children in schools;
(4) The working of the bodily functions and organs of sense;
(5) Physical exercise;
(6) The appointment of time to work and rest, including length of lessons and holidays;
(7) Healthy tone of mind and morals;
(8) Preventive and precautionary measures against infectious diseases.

Then, too, the eleven recommendations of the Royal Commissioners appointed in 1902 to inquire into and recommend upon physical training (Scotland) are worth your close attention (*Brit. Med. Jour.*, April 4th, 1903, summary). They dwelt upon the health-methods to be adopted for improvement in schools, universities, and continuation-classes, for feeble-minded and cripples, and advice was given on medical and general inspection, on feeding, system in teaching, training of teachers, and the value of auxiliary agencies.

The views of Miss A. Ravenhill are widely accepted and can be read in the Journal of The Sanitary Institute, July, 1899, and April, 1902, the latter containing an account of school-hygiene in the U.S.A. Miss Ravenhill recommends that systematic practical lessons in hygiene should be continuously given in the seven standards in elementary schools, to be characterised by simplicity of treatment and a natural development from certain essential principles, and to be suited for both sexes.

In Standard I. the attention is to be directed year by year to the essentials of a healthy, happy home, its comforts and conveniences, such as light, air, space, cleanliness, surroundings, repairs, rent, and fittings; some outline of the protection afforded to all by the public health laws is to be given in Standards VI. and VII.

Dirt dangers in the person, home, and community are selected for subject 2; cleanliness and comfort for subject 3; air, food, and water, subject 4; with hints on rest, work, and play. The series is concluded

by lessons on the care of the person, on the preservation of the health of the person and community. An outline scheme for teaching through the seven standards, and specimen-lessons are appended to this excellent paper.

Such experience as I have gathered *personally* leads me to emphasize in summary as follows :—

1. The vital need for close attention to the hygiene of school-rooms and life. I would ask, for instance, how any teaching in hygiene can appeal to the healthy instincts of childhood when they are allowed, or even authorised, to breathe a polluted school-atmosphere from day to day. Children are impressionable, and any such teaching becomes worse than useless, for it makes hygiene a sham and an object of ridicule when the laws they learn are daily broken. Ventilation is largely a matter of opening windows, and classes can often be given, in summer at any rate, in the open air. The herding together of many people, at work or at play even, in a foul atmosphere, together with inadequate nourishment, and finally the presence of infectious germs, are the potent causes of *tuberculosis.*

We may well note that school authorities in Paris recognise this in the fight against this human scourge, and send their children yearly into the country. At any rate the 11th Ward sends 3,000 children year by year, between the ages of ten and thirteen, for a three weeks' course of open air and good food yearly in a country-house in the Vosges Mountains in batches of 200.

Hygiene in the school-room and adequate nourishment is demanded, and might properly be supplemented by open-air classes, nature studies, and visits to the country.

2. The Ministry of Education, H. M. Inspectors, and Education Authorities should see that the elementary principles indicated previously are universally taught, and physical exercises carried out.

3. All hygienic arrangements should be supervised by medical officers with special knowledge and authority, so closely to my mind are the problems dependent on medicine.

4. Teachers should be required to show their knowledge and conviction of health-principles and the laws governing the spread of infective diseases before receiving their certificates.

5. The national conscience should be aroused to the need for safeguarding ourselves against disease by the formation of a Ministry of Public Health, and an organised health-service in all counties and districts.

OBITUARY.

Field-Marshal His Royal Highness George William Frederick Charles Duke of Cambridge, Earl of Tipperary, and Baron Culloden.

By SIR JOSEPH FAYRER, Bart., K.C.S.I., LL.D., M.D., F.R.S.
(Vice-President.)

THE announcement of the Duke of Cambridge's death on the 17th of March, 1904, was received with the greatest regret by the community generally, as well as by the public institutions over which he presided or with which he was connected, and which had benefited by his great experience and practical common sense, his cordial sympathy and his valuable co-operation. By none, probably, was the sad event more deplored than by The Sanitary Institute, of which, at the time of his death, His Royal Highness was the venerated and greatly respected President. It is in association with the affairs of this Institute that we now refer to the late lamented Royal Duke, the catholicity of whose sympathy with the Army of which for forty years he was the head (as well as with numerous charitable, beneficent, and other public bodies in which he took the greatest interest, and on whose behalf he exercised the influence of his generous, kindly, and philanthropic nature as well as that arising out of his exalted position) has been fully and gratefully acknowledged in the various obituary notices which have already appeared. It is, however, becoming that The Sanitary Institute, for which the Duke did so much, should place on record a separate notice of His Royal Highness's services on its behalf.

The Duke of Cambridge became a member of the Parkes Museum in July, 1883, when the Duke of Albany was President. On the incorporation of the Museum with The Sanitary Institute in 1888 he joined the amalgamated society, in 1895 was elected President, and from that time onwards his efforts had been strenuously devoted to its development. He was present at the Congress of The Sanitary Institute at Newcastle-on-Tyne in 1896, where he evinced the greatest interest in the proceedings, spoke at several of the meetings, and opened the Exhibition held in connection with the Congress. He presided at the twenty-first com-

memorative dinner of the Institute in July, 1897, which occurred during the busy period of the Jubilee celebrations, and on several occasions since then has taken the chair at the annual dinners.

Especially to be remembered, however, are the signal services that His Royal Highness rendered during the early history of the Institute. In 1885 the Museum was in serious difficulties for want of funds, and Sir Douglas Galton wrote a letter to the *Times* calling attention to its need of support. On seeing this letter the Duke of Cambridge wrote to Sir Douglas Galton, asking if he could help in any way to reinstate the Museum, and forthwith took an active part in furthering the success of a public meeting at the Mansion House, which he not only attended, but where he personally urged the importance of the undertaking, with the result of an accretion of funds which rescued the Museum and enabled it to be continued as the present successful and valuable public institution which is contributing to the sanitary welfare of the country.

The Sanitary Institute, whilst, like many other public institutions, deploring the loss of the Royal President, feels that its long period of active work in the past and its anticipation for the future has been materially influenced by the guidance and direction of the great man who, full of years (nearly eighty-five) and of honour, has passed away. The office vacated will not be an easy one to fill, but the memory of his predecessor's valuable work will be a stimulating incitement to the next incumbent to endeavour to follow in the footsteps of the great Prince, who made his exalted position ancillary to furthering the progress and welfare of an institution which, under his guidance, has become of great importance to the well-being of mankind.

The memory of the late Duke will long be preserved among scientific men, and his name will be associated with those of other great leaders in hygiene-work, which has resulted in the prolongation of life, the enhancement of the physical and, with it, the moral well-being of the human race. The Duke conferred great benefits on the nation, not only in his military capacity, but as a supporter of all those departments of science and art which contribute to human progress.

It was well said in Westminster Abbey by Canon Henson, "It is a great thing to say in summary of a career, lived throughout its whole course in the widest publicity and protracted to the extreme verge of human life, that it was the life of a typical Englishman, and as such commanded the affectionate respect of a nation which, beyond other nations, venerated sincerity, duty, and religion"; and by the leader in the *Times* of March 18th, "What public life will miss in him is the spectacle

of a bluff, loyal, hearty English gentleman, who carried a soldier's sense of duty into much more than his military occupations."

Such, indeed, was the character of the Royal Prince whose loss as its President The Sanitary Institute has to mourn, and whose memory will be cherished by the Institute in the growth and evolution of which he took so great a part.

SIR THOMAS SALT, BART.,
Vice-President.

By the death of Sir Thomas Salt, Bart., of Weeping Cross and Standon, in the County of Stafford, the Institute loses one of its most influential Vice-Presidents. Although in his 74th year, Sir Thomas continued up to the last to live a busy life, still taking an active part in the numerous philanthropic movements to which he has always devoted so much thought and energy, while at the same time he showed little inclination to sever his connection with the work of public authorities and commercial undertakings.

From Rugby Sir Thomas entered Balliol College, Oxford, taking his B.A. degree in 1853, with first class honours in Law and History, and his M.A. in 1856. On leaving the University he entered the banking house of Messrs. Stevenson, Salt, and Webb, of which his father, Mr. Thomas Salt, was the head, and which was subsequently amalgamated with Lloyd's Bank. In 1859 he was returned to Parliament as a moderate conservative by the electors of Stafford. On the dissolution of Parliament in 1865 Mr. Salt did not seek re-election, as the business of the banking house, owing to the death of one of the partners, required more close attention from him than was consistent with his idea of his duty as a representative of Stafford. Three years afterwards, the then members for Stafford having been unseated on petition, Mr. Salt was again returned to Parliament, but in the contested election of 1880 he was not elected, two liberals being returned for the Borough. The following year, however, one of the sitting members died and Mr. Salt was successful in the Parliamentary contest which followed and again represented Stafford in Parliament, this time as the only representative, the Borough, by the Redistribution of Seats Act, having lost one of its representatives. In the 1885 election Mr. Salt was defeated by the liberal candidate, but one year afterwards, in the election following the introduction of the Home Rule Bill, he was again returned to Parliament. Failing health prevented him from contesting the seat in 1892 and a liberal candidate was returned,

while in 1895, when Mr. Salt again contested the seat, his opponent managed to secure re-election by the narrow majority of 12 votes.

Sir Thomas, as a politician, was not a bigot, nor did he court sensation or popularity. That his value was appreciated in the House of Commons, however, is evident from the important offices which from time to time were entrusted to him. From 1875 to 1880 he acted as Parliamentary Secretary of the Local Government Board, and during the latter part of that period was also a Church Estates Commissioner. He was an Honorary Commissioner in Lunacy from 1882 to 1886, and Chairman of the Lunacy Commission from 1886 to 1892. He had been a Public Works Loan Commissioner since 1875, and an Ecclesiastical Commissioner since 1880. Sir Thomas was also an active worker on Parliamentary Committees, and it is interesting to note that he was Chairman of the Police and Sanitary Bills Committee when the London Public Health Act was passed. It is an open secret that Lord Iddesleigh thought so highly of Sir Thomas's abilities that he spoke of him as a suitable man for the post of Financial Secretary to the Treasury, or even as possible Chancellor. The somewhat fickle affections of the Stafford electors, however, broke that uninterrupted career in the House of Commons which, as a rule, is necessary for promotion to the higher posts of office. The baronetcy conferred upon him on his retirement from parliamentary work was no doubt intended as a recognition of his valued services during a long parliamentary career.

Notwithstanding Sir Thomas's busy life in Parliament and in connection with the large business undertakings in which he was prominently engaged, he was ever ready to take an active part in any movement having for its object the welfare and happiness of the people. In the public life of the County of Stafford he also took an active and leading part, and it can well be understood, considering his large and varied experience, that his valuable services were universally appreciated. For many years he was a Justice of the Peace and a Deputy-lieutenant for the County. He was a member of the County Council at the time of his death, having been elected among the first batch of aldermen in 1899; he devoted much time to the work of that body and served on the General Purposes, Education, Finance, and Sanitary Committees. The successful working of the County Council as a business body and a public health authority, and the entire absence of politics or personalities at its meetings, were contributed to, in no small measure, by the wise support given by Sir Thomas to the initial policy of his life-long and intimate friend Lord Harrowby, the late distinguished Chairman of the Council.

Sir Thomas was a staunch though liberal-minded churchman, and among his numerous other engagements he gave much time to diocesan work. He was a member of the Diocesan Conference, and was one of those elected by the lay members of the Conference as members of the Provincial House of Laymen. He was a diocesan trustee, an assessor appointed by the Court of Quarter Sessions under the Clergy Discipline Act, a joint treasurer of the Lichfield Diocesan Society for Promoting Church Extension, a trustee of the charity for the relief of widows and orphans of poor clergymen, and a member of the Lichfield branch of the Queen Victoria Clergy Fund.

Sir Thomas was a Trustee of The Sanitary Institute from 1879 to 1888; he was elected a Member in 1878 and later in the same year a Fellow, and in 1897 he accepted office of Vice-President.

Sir Thomas was not a man who lightly undertook responsibilities, but, having undertaken them, he spared neither time nor trouble in doing his best for the cause whatever it might be. That this was so is all the more remarkable considering the great business responsibilities which devolved upon him as Chairman of Lloyd's Bank up to within a few years of his death, and Chairman of the North Staffordshire Railway Company.

Sir Thomas leaves a widow, four sons, and two daughters, and is succeeded in the title by Major Thomas Anderdon Salt of the 11th Hussars, who is a Justice of the Peace for the County of Stafford.

G. R.

SIR HENRY THOMPSON, BART., M.B., F.R.C.S.,
VICE-PRESIDENT.

Sir Henry Thompson, surgeon, novelist, art critic, collector, and littérateur, after an active and useful life of over fourscore years, has passed away, and The Sanitary Institute mourns yet another gifted vice-president.

A man who would have been successful in any walk of life, of large views, and of unusual intellectual capacity, he was driven by his versatile nature to take part in a variety of movements, amongst them being hygienic advancement.

It was owing to his zealous encouragement and initiative that the Cremation Society was founded. In fact, his chief reputation as a hygienist is based upon his ceaseless advocacy of the safe sanitary method of burning the dead; he lived long enough to see his efforts crowned with a considerable amount of success, to see year after year additional crematoria constructed, and an ever-growing number of persons directing in their wills that their remains should be reduced to ashes.

Sir Henry Thompson has again and again pointed out that a whole

army of persons, some 50,000 strong, are buried annually on valueless, misleading, or imperfect certificates, and insisted on a reform of the whole method of registration of the cause of death.

Since accuracy alone makes the mortality statistics valuable, and the science of hygiene in great part rests upon such statistics, his contributions to current literature on this subject received the support of all engaged in public health work, and it is to be regretted that as yet no steps have been taken to carry out his views.

Although of late years Sir Henry has not been able to take an active part in the meetings and discussions of the Institute, he has ever been in sympathy with its aims and objects and willing to render assistance.

Sir Henry Thompson has been a Vice-President since 1890.

The Institute participates with a very large circle of personal friends in regret at his loss. A. W. B.

SIR EDWARD H. SIEVEKING, M.D.EDIN., F.R.C.P., LL.D.

Physician Extraordinary to H.M. The King.

Sir Edward Sieveking came of a Westphalian family long settled in Hamburg. Business brought his father to London in 1809, and the son was born in St. Helen's Place in 1816. He was educated partly in Germany, partly in England, and finally in Edinburgh, where he graduated M.D. in 1841. He began practice in Hamburg in 1842, took a leading part in founding a children's hospital there, and wrote a work on ventilation. He commenced practice in London in 1846, and contributed many reviews of foreign science and literature to medical periodicals. In 1855 he became Editor of the *British and Foreign Medico-Chirurgical Review*, a post which he retained for five years. In 1851 he was appointed Assistant Physician to the then newly established St. Mary's Hospital, with which he remained connected to the day of his death, becoming Physician in 1866, and finally, on his retirement in 1888, Consulting Physician. He was appointed Physician to the Prince of Wales's household in 1863, was afterwards Physician in Ordinary to Queen Victoria, and on the accession of King Edward VII. was nominated Physician Extraordinary. He was Croonian Lecturer at the Royal College of Physicians in 1866, Harveian Orator in 1877, and for a time held the office of Vice-President of the College. He was a voluminous writer, chiefly on pathology and diseases of the nervous system, but always displayed great interest in hygiene. He knew and admired Dr. Edmund Parkes, and at the meeting on July 18th, 1876, at which it was resolved to found a museum of hygiene as a permanent memorial to Parkes'

memory, Sieveking was entrusted with the duty of moving one of the resolutions. He was a Member of the Council of the Parkes Museum until its amalgamation with The Sanitary Institute, and gave his services to the Institute in a like capacity for a short period. He took a great interest in the movement for the improvement of sick nursing, in the work of the Red Cross Society and the St. John's Ambulance Association, and assisted Mr. Propert to found Epsom Medical College. Sir Edward Sieveking was a man of great industry, independence, and force of character, who led a very full and useful life, during which he conferred many benefits on the country of his adoption. D. W.

HENRY SAXON SNELL, F.R.I.B.A.,

FELLOW AND MEMBER OF COUNCIL.

Mr. H. Saxon Snell, whose death occurred on January 10th, in his 73rd year, was one of the earliest members of The Sanitary Institute, and came on to the Council in 1879. He was for many years a member of the Board of Examiners, one of the Judges of the Exhibition, and an active member of other standing committees.

His principal professional work was in connection with Poor Law and municipal buildings, and the workhouses, infirmaries, and dispensaries designed and erected by him make a long list of well-known buildings.

Hospitals, also, he was much interested in, and the Royal Victoria Hospital at Montreal, the Forres Hospital, N.B., the Hospital for the Sick Poor in Rackham Street, and the Victoria Hospital for Children are among those designed by him. At the Congress of The Sanitary Institute in Leicester in 1885, he read a paper on "Circular Hospital Wards," and it is not too much to say that his exposure therein of the fallacies of the system did much to stay its adoption in this and possibly in other countries. In conjunction with the late Dr. Mouatt he published "Hospital Construction and Management," a work in which he described in comparative form all the best types of hospitals in this and other countries.

In connection with this work he visited a number of the hospitals on the Continent in company with Dr. Mouatt and Mr. P. Gordon Smith (late architect to the Local Government Board); he also visited several in America. He continued his interest in the subject to the very last, and only the week before his death he was discussing a scheme for utilizing the public parks as sites for hospitals.

His principal work in hospital design is a building not much known over here, the Royal Victoria Hospital, Montreal, erected in 1889, which is in many respects in advance of anything done in this country before or since.

For the past twenty-five years he took a very keen interest in the subject of ventilation, and as far back as 1882 published the result of a number of experiments made personally to test the accuracy of registering anemometers. Later on, when living at Hampstead, he erected in his stables a gas-engine and other plant for the purpose of continuing these experiments.

He was fond of mathematics, although probably he studied them rather as a means to an end (and that end mental clearness) than as an amusement. His papers show that he studied the integral calculus long after he was in practice, at a time when most men are content to limit their studies to the school of experience. Many of the members of The Sanitary Institute know that he was interested in improvement of all kinds of sanitary apparatus, and with the object of furthering this branch of sanitary work he has bequeathed to the Institute a sum of £750, to be applied as to Fifty Pounds thereof, and as to the income of the remaining £700 every third year afterwards for a Scholarship or Prize, to be called the "Henry Saxon Snell Scholarship or Prize" to encourage improvements in the construction or adaptation of Sanitary Appliances.

On account of failing health Mr. Snell had for several years been unable to take an active part in the Institute, but his genial personality will be long remembered by his colleagues on the Council and in the Institute. T. W. C.

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT MEETINGS OF THE INSTITUTE.

Recommendation made at the Sessional Meeting in London on December 9th.—

"That this Meeting is of opinion that the Flooding of London Basements with sewage is a grave menace to public health and regrets that this menace has been allowed to continue for so many years, and requests the Council of the Institute to urge the London County Council to proceed with all possible expedition to the completion of the necessary works upon the main sewers and relieve London from its present insanitary state."

The Council resolved that in view of the grave danger arising from the Flooding of London Basements, the Institute desire to urge on the London County Council the desirability of expediting in every way the works undertaken for removing the evil.

NOTES ON LEGISLATION AND LAW CASES.

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WATERWORKS.—*Land compulsorily taken—Compensation—Special adaptability.*

Where land is compulsorily taken for the purpose of making a reservoir, the fact that the land has peculiar natural advantages for supplying a district or area, apart from any value created or enhanced by the scheme or Act for appropriating the water to a particular local authority, may be taken into consideration in the assessment of compensation; and it is not necessary that it should be proved that the land could be similarly used by other specified local authorities.

Judgment of Wright J. (1903) 1 K. B. 574, affirmed.

In re Gough and Aspatria, Silloth and District Joint Water Board, C. A. (1903) 417.

LODGING-HOUSE.—*Lime-washing—Validity of By-law—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 94, sub-s. 1 (d), (e).*

In two metropolitan boroughs a by-law with respect to houses let in lodgings was made by the Council of the borough under s. 94 of the Public Health (London) Act, 1891, requiring the landlord of a lodging-house (the definition of which included any house occupied by the members of more than one family) to cause every part of the premises to be cleansed, and the ceilings and interior walls to be lime-washed, in the first week of April in every year. In one case "landlord" was defined as the person who received the rack-rent of the premises; and in the other case the definition included the person who received the profits arising from the letting of the house as a lodging-house:—

Held, that having regard to the wide definition of lodging-house and landlord the by-law was, in both cases, unreasonable and bad, because it contained no provision that a landlord, before becoming liable to a penalty for a breach of the by-law, should receive notice that the requirements of the by-law had not been complied with:

Held, also, by Lord Alverstone C. J., and Kennedy J., Willis J. dissenting, that so far as the by-law required the work to be done in the first week of April, the by-law was not unreasonable.

Stiles *v.* Galinski. Nokes *v.* Islington Corporation (No. 2). Div. Ct. (1903) 615.

SANITARY INSPECTION OF SCHOOLS.

Dr. Butler-Hogan, the Medical Officer of Health for Tottenham, applied on January 28th for a justice's order to inspect the Drapers' Schools in his district, to which the sanitary officials had been refused admission, in the first place by Miss Beggs, the head mistress, and afterwards by Mr. Riley, the surveyor to the Company. The medical officer explained that the application was made under Sec. 102 of the Public Health Act, 1875, the wording of which was, in his opinion, absolutely clear upon this point, the words being: "The local authority

or any of their officers shall be admitted into any premises for the purpose of examining as to the existence of any nuisance thereon." It was most important that there should be the same right of entry and inspection with regard to the most lordly premises as there was to the poorest hovel in the district: this was even of still greater importance when the premises were schools. One sixth of the population of Tottenham, and probably the most important sixth, consisted of school children. He had offered to have the inspection made during the Christmas holidays, so as not to interfere in the slightest with the work of the school, but the officials of the company had perhaps calculated that he might be too lazy or too cowardly to carry this matter through the Law Courts.

In no other school in the district had there been the slightest opposition to the sanitary officials in the discharge of their duties.

Mr. Nairne, on behalf of the Company, opposed the application on the grounds that the medical officer of health had arbitrarily refused to specify any particular grounds of complaint, and had claimed a general right of inspection at any time. He deprecated the medical officer's remark regarding the Company, who were quite satisfied that their surveyor (Mr. Riley) took every possible care of the sanitary condition of the schools. The drainage had been seen to some five months ago, and he believed it was right now. He thought the medical officer should be called upon to particularise any complaint he had received, and submitted that unless this were done the justices were not entitled to grant an order, and he quoted the case of Vyne, under the Public Health (London) Amendment Act, as being on a similar footing.

Dr Butler-Hogan, in reply, said that he did not wish now to discuss any Act which did not apply to his own district, and that under no circumstances would he disclose information received in confidence by him; the words of the Section were, he again reminded the Bench, "for the purpose of examining as to the existence of any nuisance," not for the purpose of verifying or corroborating the existence of such.

In the result the Bench granted the medical officer the order applied for.

GENERAL NOTES.

SEWAGE DISPOSAL BY THE PAIL SYSTEM IN KING WILLIAM'S TOWN, CAPE COLONY, S.A.

By C. Anthony.

It has occurred to the writer that a brief note on the excellently organized system of sewage and refuse-disposal in force in the Town of King William's Town, Cape Colony, might be of interest to the Institute.

The Town, 1,300 feet above sea-level, has a population of about 7,000 Whites, and 3,000 Natives, or a total of 10,000 inhabitants.

The system of sewage-disposal is the pail, which, under the intelligent direction which prevails, has proved itself well able to cope with the removal of the waste-products of a town of this size, even under the trying climatic conditions which prevail, King William's Town being one of the hottest spots in the Colony.

In accordance with By-laws promulgated in March of 1898, the citizens are obliged to build privies to the satisfaction of the Borough Council, and to provide for each a couple of galvanized iron pails having closely fitting covers and detachable handles. These are supplied of a standard pattern by the Council at a charge of 8s. each.

These pails are removed as often as may be required, but never less than once a week, the Sanitary Inspector being made the sole judge of the number of weekly removals necessary, and a proportionate charge is made of 9s. per quarter for one removal, 15s. for two removals, 21s. for three removals, and 42s. for six removals weekly.

The removal is effected by a properly organized night-service of closed vans, provided with racks to carry pails to the number of sixty per van. These visit certain districts in rotation carrying empty pails, which are substituted for the full ones removed.

For the disposal of the night-soil thus collected, a plot of ground some thirty acres in extent has been set apart a mile east of the Town. Trenches some 2 ft. 3 in. wide and 1 ft. 6 in. deep are cut in parallel lines at a distance of about 6 ft. from centre to centre, the amount of trench cut and filled each day averaging about twenty lineal yards. Into one of these the night-soil is thrown, being immediately covered with kitchen-refuse brought by a separate system of ordinary ash-carts. The trench is about half filled in this manner, the filling being completed from excavation of a continuous trench.

After several rows of trenches have thus been filled, trees are planted not in the trenches themselves, but in the ground between them. The class of trees found most appropriate are the Eucalyptus rostrata and tereticornis, the Pinus halepensis and the Black Wattle. These are first grown, for from six to nine months to a height of at least one foot, in ordinary soil, before being transplanted to the depositing grounds.

The pails emptied of their contents are taken to an open galvanized iron shed, where they are thoroughly washed in running water three times, and scrubbed with stiff bristle-brushes. They are then dipped in a disinfecting solution consisting of one gallon of Jeyes' fluid to fifty gallons of water, and are stacked to dry, ready for use the next day. Special pails of a distinctive pattern, easily distinguished from those in ordinary use, are issued on the notification of the existence of infectious disease by the medical officer, and these are removed in a special van and are cleaned and disinfected in a separate shed.

In the case of domestic houses the urine is of course removed in the pails together with the night-soil, but when large establishments are in question, such as schools, hotels, manufactories, and public buildings, urinals are fitted draining into pails containing sawdust. These are emptied into a urine-tank-cart, and are dealt with in the same manner, and at the same charge per removal, as the night-soil pails.

The kitchen- and bath-water, slops, &c., are allowed to flow by the surface-concrete or stone-curb-gutter of the streets to the River Buffalo. The gutters are regularly swept by employees of the Council, and the throwing of any injurious matter into them is a punishable offence.

The population served may be taken as 7,000, and the staff employed consists of three men with each of the six collecting vans in constant use, two men with each of the two urine-tank-carts, and a foreman in charge of the depositing ground, with four men trenching and three washing; or a total of thirty men in addition to the Inspector and clerical staff.

FIRST INTERNATIONAL CONGRESS OF SCHOOL HYGIENE, NUREMBERG, APRIL, 1904.

BY F. E. BATTEN, M.A., M.D., F.R.C.P.

This Congress was held at Nuremberg in April, 1904. The English interests at the Congress were represented by a special committee formed by members of various organisations interested in education and school hygiene. The formation of this committee was due to the energy of the medical officer to the London School Board, Dr. James Kerr. The English committee includes representatives of the following bodies: the Royal College of Physicians of London, the Royal College of Surgeons of England, the London School Board, the Medical Officers of Schools Association, the Incorporate Society of Medical Officers of Health, the London School of Medicine for Women, the Childhood Society, the Child-Study Association, the National Union of Teachers, and The Sanitary Institute, and was under the presidency of Sir Lauder Brunton.

The number of members of the Congress amounted to 1,700, and included not only medical men and schoolmasters, but a large number of persons interested in education and hygiene, but only about 900 members were present at the Congress. The general meetings of the Congress were held in the Apollo Theatre, and were largely attended.

The opening of the Congress was performed by His Royal Highness Prince Ludwig Ferdinand of Bavaria, and it was obligatory on the delegates to appear in evening dress.

Professor GRIESBACH, the President of the Allgemeinen Deutschen Verein für Schulgesundheitspflege, to whom all credit is due for the inauguration and success of the Congress, said that no less than twenty European and extra-European States (United States and Japan) were represented at the Congress, and that Turkey and Italy alone were unrepresented. The delegates from the various countries then spoke, and Dr. A. EICHHOLZ, His Majesty's Inspector of Schools for the Blind, Deaf, and Defective, replied on behalf of Great Britain.

The Exhibition and Sectional Meetings of the Congress were held in one of the school buildings, of which there are several in the town. The building was most excellently adapted for the purposes of the Congress. On the ground floor was an office and central bureau, where all information with regard to the meeting could be obtained, and where the daily journal was issued. There was no difficulty in obtaining the necessary cards and information with regard to the Congress, and the general management of the business was excellent.

In the basement of the building was held the exhibition of apparatus, books, games, educational diagrams, plans of ventilation, and architectural drawings of school buildings.

On the upper floor rooms were provided as reading room, offices, and for the work of the various sections. These were well arranged, and there was no difficulty in finding any section required.

The sections were well attended and the discussion well maintained.

The work of the Congress consisted of general meeting and sectional meetings; the first were practically addresses, while the second were papers on which discussion took place.

At the general meeting the following papers were read:—

(1) What have ophthalmic surgeons done for school hygiene, and what has yet to be done?

(2) The position of school hygiene in Norway.

(3) The hygiene and personal health of the master in relation to his pupils.

(4) The arrangement of elementary schools according to the mental capacity of the children.

(5) The duties and education of the school doctor.

(6) The prevention of infectious diseases in schools.

(7) What is most required in school ventilation?

At the close of the formal business of the first general meeting of the Congress Professor COHN (Breslau) read a paper entitled "What has the Ophthalmic Surgeon done for School Hygiene and what remains to be done?" He stated that Myopia might be regarded as a widespread disease produced by school life. Further experience in the last ten years had shown that the acuity of vision in young children examined in the country was twice or three times as great as that of a child examined in the school room—similar to the great acuity of vision which was present in the Bedouin Arab. Unfortunately, the acuity of vision very rapidly diminished during the years of school life. The true cause of short sight was not even yet fully known, although there were various hypotheses. One thing was certain—that much close work, especially in association with hereditary disposition and bad lighting, produced myopia. With regard to the result attained by attention to the ocular condition of the children, it is interesting to note that in spite of all that has been done the percentage of children with short sight has not decreased.

Dr. BENDA (Berlin) spoke on the subject of over-pressure in the more advanced classes. He recommended the abolition of the so-called Abiturienten-Examen (the final examination which entitles young men to matriculate as students at the universities). No lessons should be given in the afternoons, so that the children might have ample opportunity for bodily exercises and games. Home lessons ought to be limited as much as possible. Special classes for defective or backward children ought to be arranged in the gymnasia, as was already the case in the municipal schools. The more advanced pupils ought to be at liberty to select the classes they wished to attend with a view to their future occupation or position in life. In this way the change from the restraints of school training to the wider circle of university studies would become less abrupt than under the present system.

At the last general meeting of the Congress Dr. JAMES KERR read a paper entitled "What is Most Required in School Ventilation." He said there was required for all schools some efficient method of ventilation. In small rooms this might be a modified natural system, by fires or ventilating stoves. Other systems depending on roof ventilators and climatic conditions were fallacious and whilst acting during some seasons of the year, failed in summer, and caused draughts in winter. Open windows, doors, and fireplaces, or extraction chimneys, could, by a rigorous system of window drills and the constant supervision of a skilled teacher, be utilized for most of the school year to maintain a comparatively pure air, but even these methods would fail when most wanted, as in summer. For large schools direct mechanical movement of the air was best by large fans running at low speeds. In order to avoid "short-circuiting" by opening of doors, all ducts should be as large as could be afforded and the outlets of low resistance; inlets to rooms should be high on the walls, outlets low; 2,000 cubic feet per head per hour, should be supplied. Accessory heating preferably by low pressure steam or water was advisable. The air should be well moistened.

Cloakrooms and stairways must also be ventilated. At present the chief objection to the mechanical ventilation was the sense of loss of tone from want of sufficient skin stimulation by the smoothly flowing warmed air. Probably the system of the future would be one of large supplies of very moderately heated air moved by combined propulsion and extraction by fans, with accessory heating of rooms and free permission to open doors and windows.

An interesting paper was read dealing with the arrangements of the primary Schools. Children in Germany attend school from the age of six to fourteen, and there are eight classes. Besides these ordinary classes there are so-called repetition classes for backward children; then again other classes for mentally defective children; other classes for morally defective children. Besides these there are classes for secondary education. The complication of such a scheme seems to be very great, but according to the speakers the arrangement had worked well in the town in which it was instituted.

The sectional work of the Congress was divided into seven sections:

(1) Dealt with School Buildings and Furnishing of the Schoolroom.
(2) The Hygiene of Residential Schools, the Methods of Hygienic Investigation and Research in Schools, and the Physiology and Psychology of Educational Methods and Work.
(3) Instruction in Hygiene for Teachers and Scholars.
(4) Physical Education and Training in Personal Hygiene.
(5) Contagious Diseases, Ill-health, and Conditions affecting Attendance at School.
(6) Special Schools, including Feeble-minded, Blind, Deaf, Dumb, Cripple, Invalid, and Exceptional Children.
(7) Out-of-School Hygiene, Holiday Camps, the Relation of the Home and School and the Hygiene of the Teaching Profession.

Without going into details it may be said that some of the most interesting papers were read in the sixth section. A paper by Dr. Gutzmann on Stammering and Stuttering provoked a considerable amount of discussion, and another by Dr. Wanner on the Testing of Hearing in School Children was also the subject of considerable criticism.

Dr. Clement Dukes (Rugby) read a paper on the Organisation of Physical Education. He said that the physical development of the body was of importance for the mental development, and that an energetic manhood could only be obtained by a healthy boyhood. He was of opinion that school games were important for the education of the boy, that such games should be made compulsory on all boys, and just as times were arranged for work in school, so there should be a definite arrangement of play. A boy who did not play became dull and apathetic, and became unfitted for the struggle of life. He was not in favour of Swedish exercises except in certain instances. Excessive exercise was as bad as deficient exercise and tended to stunt the body. He pointed out how necessary it was for a boy to train for his games, and he stated that most accidents during play happened at the beginning of a season, when a boy returned from holidays and in an untrained condition took up some violent form of exercise. The boy was an active animal, and it was important to give him active employment, or he would almost certainly find some occupation which might not only be useless but even dangerous. For young children he considered carefully arranged physical exercises most important, but it was to be remembered that the staying power of the young child was very limited.

The tendency of the Congress was to advocate increased specialism, not only in educational work but also with regard to medical supervision. With regard to the educational work, separate schools should be provided for the blind, deaf, defective, epileptic, and moral pervert. With regard to the medical supervision, it was suggested that besides a medical officer to each school it was necessary to have an ophthalmic surgeon, an aurist, and a dental surgeon.

A large portion of the exhibition was occupied by school desks in various forms; the general arrangements seemed to be to make the desk and seat to accommodate two children and various devices had been adopted to allow the children to stand up in their places and yet to bring the desk sufficiently near them to prevent them stooping over their work. This arrangement differs from that adopted in the English schools in that the desk is made continuous while the seats are separated for each child. Such an arrangement allows the teacher to pass behind the children and to give to each child room to stand up at the side of his place, whereas in the arrangement shown in the exhibition the teacher is at the side of the scholar and cannot pass behind him. Various mechanical arrangements were shown for adjusting the desk and seats to the varying size of the children, but all more or less complicated. One form of drawing stool may be especially mentioned as it is both ingenious in design and most comfortable to work at. It is shaped as a somewhat flattened horseshoe on four legs. At one end a pillar is fixed which carries a drawing board which can be adjusted at any angle and at any height. From the same pillar an arm projects which carries a stand on which the object to be drawn is placed. The student, male or female, sits on the other end of the horseshoe with the legs in the concavity, or if the student be a male he can sit on the stool in a straddle manner. The only objection that can be raised to such a stool is the fact that it occupies a considerable amount of floor space as compared with a chair, but in comparison to an easel it occupies but a small space.

Mention may be made of a simple form of hygrometer for school use. The advantage of knowing the amount of moisture in the atmosphere of the school-room is obvious, and means can be taken to correct the defect. Some of the diagrams for instruction appear to be worthy of note, and one showing the joints cut from the bullock would seem to be of considerable use in the education of girls in housekeeping.

Some of the models illustrating the anatomy of the human frame would appear unnecessarily complicated for such simple facts as are required in the education of children.

The type-writing machine, as used by the blind, is of interest. It in some way resembles the "Brail system," out of the various combinations of six keys any letter can be made and can be read either by the blind person or by sight. The disadvantage of the process is its extreme slowness, for the formation of nearly every letter requires the keys to be depressed three times.

The next meeting of the Congress will be held in London in 1907, and The Sanitary Institute sent a proposal to the meeting at Nuremberg offering to co-operate with the English Committee in the organisation of the meeting, and to conduct the Exhibition.

The Institute has also arranged for a short Conference and Exhibition relating to the subject to be held in January, 1905.

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DISCUSSION ON

SCHOOL HYGIENE IN ITS RELATION TO EDUCATION AUTHORITIES.

Opened by E. WALFORD, M.D., D.P.H.,
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(FELLOW).

At Provincial Sessional Meeting at Cardiff, April 23rd, 1904.

WHEN the Council of The Sanitary Institute was good enough to invite me to open a discussion at this Sessional Meeting in Cardiff, I experienced some difficulty in the choice of a subject likely to prove generally acceptable. Ultimately it seemed to me that we might perhaps usefully devote the short time at our disposal this morning to the consideration of one aspect of the education question which has not yet attracted the public attention to the same extent as other more exciting and controversial points. If we can for a moment divert the attention of those interested in educational matters from these to other, but not less useful, points connected with the health and physical welfare of the scholars, we shall, perhaps, have effected some little good. In choosing the subject of School Hygiene, I was influenced by what I hope will prove to be a well founded belief, that we should on this occasion have the advantage of the presence of some educational experts and others who have made this subject a special study, and who would be able to deal with many technical and special details with more skill and knowledge than I could hope to do. With this in view I shall only attempt a brief general survey of the question.

The present moment seems to be a suitable one for directing special attention to the subject of School Hygiene. Recent legislation has, as you are aware, transferred the management of our Public Elementary

Schools to the local authorities which are already in existence and which are intrusted with other powers and duties, especially those concerned with the public health. Practically, therefore, the educational authority and the sanitary authority are one and the same body. A fitting opportunity thus presents itself for organising a systematic and effective method of supervising the sanitation of schools and of promoting the health of the scholars on a more scientific basis than has hitherto obtained. Parliament seems to be more and more inclined in the direction of Decentralization in every Government Department and the Education Department forms no exception to this rule.

A wide discretionary power will therefore devolve upon the local educational authorities in the administration of many important matters and details connected with the working of the schools under their control. Fortunately, we have every reason to anticipate that they will exercise their powerful influence in the right direction. We must recognise, nevertheless, that School Hygiene is a department of public health of comparatively recent growth, and that it is yet in this country in an early stage of development.

The comparative neglect of hygiene in connection with school-life in time past was probably due to erroneous ideas upon the subject of education. The development of the mind and of the intellectual faculties was regarded altogether apart from the physical development of the body, regardless of the fact that the organ of mind, the brain, is an essential part of the body, and that nature has allied all the wonderful mental functions, upon which we pride ourselves, with a bodily organisation, and that the slightest damage to this organisation reacts upon those important functions. An original or acquired defect in the structure of the brain may render futile all the best efforts of the most accomplished teacher. Injurious impurities contained in the air taken into the lungs may enter the general blood circulation and seriously derange the mental faculties of the most intelligent pupil; a continuation of this process, constantly perverting the bodily and mental functions, may lead to permanent organic changes and disease. It is, therefore, a matter of grave national concern that teachers and pupils should carry on their educational work under the conditions most favourable to health. The problem for solution is, therefore, how can such conditions best be attained? It goes without saying that it is the duty of the Education authorities to provide the best attainable conditions, so as to promote the mental and physical welfare of the pupils under their care. Education authorities, whether central in London or local bodies, are largely influ-

enced in their methods by public opinion. It is the public generally, therefore, who must in the first instance be interested and convinced.

In the matter of school-hygiene some other countries are at the present time in advance of ourselves. The schools in America, Germany, and Switzerland compare favourably with anything that we have in this country. Mr. A. G. Legard, H.M. Inspector of Schools for this district, in a most interesting and instructive address to the Cardiff Architects' Society in 1902, remarked, that "In England popular opinion has not yet pronounced in favour of the people's schools being of the very best type, and till that takes place we shall have lessons to learn in school architecture, not merely from our rich kinsmen across the Atlantic, but from the inhabitants of a poor country like Switzerland." In some of the Swiss cities, he says, the primary schools rank among the finest buildings, and are sources of honest pride to the inhabitants.

The Sanitary Institute, always well to the front in the promotion of hygienic knowledge, has recently and most opportunely interested itself in the theoretical and practical instruction of those who have embraced the profession of teaching. A glance at the admirable and comprehensive syllabus issued for the guidance of students preparing for the special examination in hygiene for school teachers, which has been established by the Institute, will suggest the enormous advantage, to school children, of being under the control of teachers possessing, even in an elementary degree, a knowledge of the subjects there set out in detail, and who are able and willing to put that knowledge into actual practice. It is not of course to be expected that all teachers in our public elementary schools should be experts in sanitation, but at the same time it is perfectly obvious that there can be no real advance or improvement in our methods of school sanitation until the responsible teachers possess a fair knowledge of the principles upon which these methods should be based. The most clever and learned teacher will be a failure, from an educational point of view, unless he or she recognises that the health of the scholar is as important as its mental growth and intellectual development, and that unless the environments of the child are such as to secure the former, satisfactory results with respect to the latter can hardly be expected. It must in all fairness be acknowledged that many of the teachers in our public elementary schools are alive to the importance of maintaining in the schools under their control a proper standard of sanitation.

They possess, moreover, in many cases, a sound theoretical knowledge and practical acquaintance with the general laws of health, and the positions they hold and the profession to which they belong would

naturally imply the possession of a highly trained intellect and cultured mind. The active and intelligent co-operation of teachers is therefore essential to the success of any organised scheme of school hygiene.

In this matter the responsibilities are divided between (1) the Central Authority or the Board of Education, (2) the Local Education Authority, and (3) the officials or teachers having immediate control of the schools. With the Board of Education we are not so much concerned to-day; as an organisation for propounding excellent principles it would appear to be everything that could be desired. It is the Local Authority, the school managers and the teachers with whom we have to deal, who are intrusted with the duty of carrying into effect the principles admirably laid down in the various codes, regulations and memoranda of the Board, and who are therefore immediately responsible for maintaining an effective supervision over their schools. The Central Board has doubtless at its disposal the best expert advice in the country, and a staff of highly qualified and efficient inspectors, but it has apparently no very effective machinery for enforcing the recommendations which it makes: much, therefore, is left to the discretion of the local bodies. It is hardly necessary before an audience of this kind to dilate in detail upon the evils likely to arise from a policy of neglect and indifference on the part of those responsible, but there are certain points which I think that we cannot too frequently emphasise: points which are constantly brought to the cognizance of medical officers of health, and of those who are in the habit of visiting schools officially and unofficially, which indicate the necessity of some better method of exercising sanitary supervision over these places. I will mention one or two simple examples in this connection, not however with the view of selecting any particular schools for adverse criticism, as I believe similar conditions could be found elsewhere. One day on visiting a class-room in the infant department of one of our public Elementary Schools I noticed that the air was unusually stuffy, and that most of the windows were shut. On making inquiry I was told the reason: One of the assistant teachers was suffering from toothache and was afraid of a draught. This was one of the class-rooms, of which there are many, which from inadequate arrangements and appliances could not be ventilated without creating a draught.

On another occasion I found in a large class-room of one of the elementary schools all the windows firmly closed, the only opening to the fresh air being a small permanent ventilator in the roof, which probably would also have been closed but fortunately it was sufficiently inaccessible, and notwithstanding complaints of descending currents of cold air it had

remained open. I was accompanied by the chemist attached to our Public Health Laboratory, and we were about to take a sample of air for examination, but before we had time to look round, the head-master gave hurried instructions to a small boy to open the windows and the opportunity was lost. These are simple everyday examples of what is to be found in many school-rooms in which the heating and ventilating arrangements are so inadequate that it is impossible to open a window without creating an unpleasant draught of cold air, consequently they are kept closed. Examples of this kind are doubtless familiar to most of us, and further comment seems hardly necessary; but perhaps I may be permitted to give the results of some analyses of the air of school-rooms made for me by Mr. J. H. Sugden, in our laboratory. Taking the universally recognised standard of 4 parts per 10,000 as the amount of carbon dioxide present in fresh air, and 6 parts per 10,000 as the limit which should not be exceeded in an inhabited room, and assuming as is usually done that the quantity of CO_2 present is an approximately accurate index of harmful organic impurity in the air, it must be admitted that few of the rooms examined reached a high degree of excellence so far as the purity of the air they contained is concerned. The air of twenty-six class-rooms was examined and the amount of CO_2 found to be present ranged from 6·2 to 18·0 parts per 10,000. In three of the rooms the amounts ranged from 16·0 to 18·0. In twelve rooms between 9 and 14 parts, and the remainder between 6·2 and 9·0 parts per 10,000. The examinations were made between 2.30 and 4.30 p.m., in February and March. In sixteen of the rooms the temperature ranged from 54° to 59° F., in the others between 60° and 62° F.

These results are not of course brought forward as representing anything like a complete examination of the air of our schools, nor with the intention of suggesting that the ventilation of the rooms examined was in a worse condition than that of the generality of schools in this or any other district in the country, but rather with the object of indicating the necessity of a systematic and constant chemical and bacterial examination of the air of public schools, and of a more efficient control over the ventilating arrangements of these buildings.

In the report of the Departmental Committee on Factory Ventilation (1902), Dr. J. S. Haldane shows that the average proportion of CO_2 in a large number of workrooms amounted to 10·1 volumes per 10,000 in the daytime, and that this compared favourably with the average proportion found in the elementary schools of Dundee, which amounted to 18·6 volumes per 10,000 with natural ventilation and 12·3 volumes with

imperfect mechanical ventilation. To the impurities from respiration must be added those due to the combustion of coal gas when artificial illumination is necessary, a by no means infrequent occurrence in some schools. Fortunately however, as most school-rooms are fairly high and the products of combustion are lighter than air, the circulation of the vitiated air from gas jets is to a large extent above the breathing level. With a proper system of control over the sanitary arrangements of schools on the part of the Local Education Authorities, there would be, I presume, nothing to prevent the adoption of a standard limit of carbon dioxide. A notification sent by the responsible authority to the head-master or mistress whenever this limit was found to have been exceeded, would probably in most cases lead to more attention being given to the existing means of ventilation and warming. There can be no doubt that in many of the old schools and in some of the new the warming arrangements are very imperfect, and that this greatly adds to the difficulty of admitting a proper amount of fresh air. Notwithstanding the excellent rule of the Board of Education that an "iron stove, with a pipe through the wall or roof, can under no circumstances be allowed," many of these objectionable heating appliances are to be found, and it is to be feared that those responsible have taken literally the preamble to the rules which states that "they are intended to show school managers and their architects what the Board deem essential in the construction and design of school buildings, but in other respects they are not meant to restrict liberty of treatment." On a recent occasion my attention was drawn to a certain school in which it was alleged that in one of the girls' class-rooms many of the pupils were constantly attacked with illness. The symptoms, as described by the head-mistress, who was an intelligent observer, were headache, sickness, extreme drowsiness, passing in some cases into more or less complete coma or syncope with convulsive muscular movements. The history of the cases and the symptoms were extremely suggestive of poisoning with carbon monoxide gas. This gas, as is well known, is extremely dangerous when breathed into the lungs, combining with the hæmoglobin of the blood, and therefore interfering with its function as a carrier of oxygen, and producing asphyxiation. It is sometimes introduced into rooms in which cast-iron stoves are used with coke as fuel. Under these circumstances the products of combustion from the stove or flue gain access to the air through the heated iron, and the carbon monoxide is evolved. In this particular room there was one of these cast-iron stoves with a pipe through the wall, which the Board of Education states should not under any circumstances be allowed. This

arrangement infringed all the conditions under which only stoves are approved by the Board, *i.e.*, (1) It was not provided with a proper chimney (as in the case of open fires); (2) It was not of such a pattern that it could not become red-hot or contaminate the air; (3) and it was not supplied with fresh air direct from the outside by a flue of not less than 72 inches superficial. It is only right to say that a sample of the air was submitted in our laboratory to Vogel's spectroscopic test and that no indication of the presence of carbon monoxide was given. This single negative test was of course no indication that the gas was not present on other occasions.

The ventilation and warming of schools is undoubtedly a matter of some difficulty. It is obvious that we cannot depend upon open fireplaces for heating distant parts of large school-rooms or class-rooms, valuable as they are as aids to ventilation, therefore some form of hot water or steam heating is necessary, and this usually implies some method of artificial or mechanical ventilation, as no system of heating can be satisfactory which does not at the same time assist ventilation. There is, I think, a consensus of opinion that for large schools and class-rooms better results can be obtained by mechanical than by natural ventilation. For instance, we have the authority of Dr. Kerr that in the Bradford Elementary Schools the amount of CO_2 in the mechanically ventilated rooms was never found to be above 8·5 vols. per 10,000, whilst in the so-called naturally-ventilated schools it was never below 9 vols., and reached as high a figure as 31 vols. of CO_2 per 10,000. In well-ventilated schools it should be possible to supply from 1,700 to 2,000 cubic feet of air per child per hour, entering the room at an average velocity not exceeding five feet per second. This is quite impossible without mechanical ventilation. It may be said also that the lighting of schools is connected with ventilation. It is to be feared that in some rooms the assistance of the gas jet is invoked as an aid to the imperfect heating arrangements regardless of the increased contamination of the air. Hence the value of the electric light, the most sanitary of all artificial means of lighting. Probably the most urgently needed reforms in most large school-rooms are improved methods of heating, combined with an artificial system of ventilation, such as the Plenum system, or the Plenum in conjunction with a properly arranged exhaust system, and the installation of the electric light. Any such improvements necessarily require for their complete efficiency a much larger amount of air space than is at present required by the Board Regulations for each unit of average attendance. In these matters school authorities should take the advice of independent scientific experts.

Amongst other important points connected with the structure of the school-room, or rather perhaps with the furniture of the room, which have as yet received far too little attention may be mentioned the form of desk and seat at which the pupil has to spend so much time. It is a wonderful and painful sight to behold a child on his or her return home for the holidays attempting to write a letter. From the remarkable muscular and facial contortions gone through, one can only wonder that spinal curvature, impaired vision, and St. Vitus dance are not of more frequent occurrence. Imperfect forms of desks and seats and improper modes of handwriting are largely responsible for those disorders when they occur amongst school children. Certainly improvements have taken place recently, but even now are to be found rows of desks and benches which perhaps might not be so unsuitable if children of the same age were always of the same size. I have never been able to see the advantage of paragraphs (*a*) and (*c*) in the new rules of the Board of Education issued 1902, which are as follows:—"No desks should be more than twelve feet long. In an ordinary class-room five rows of long desks or six rows of dual desks are best, but in a school-room, or a room providing for more than sixty children, there should not be more than four rows of long desks or five rows of dual desks . . . Single desks are not necessary in an ordinary public elementary school and cannot be approved." Perhaps there are some here who will be able to explain this emphatic disapproval of single desks. I am personally much inclined to think that there are great advantages in single and properly adjustable desks and seats, advantages to the physical state of the pupil and possibly educational advantages. In any case our American friends are strong advocates of single desks. Professor Shaw, of the New York University, states that "every school ought to be furnished with single desks and seats. No double desks, or desks at which four pupils may sit, should be permitted in this age in any school," and he gives most excellent reasons for this advice. Improper chairs and desks, he says, "at which pupils are obliged to sit, the wrong postures which they are allowed to take in standing as well as in sitting, and the muscular fatigue caused by the inactivity of a great number of the muscles of the body for a long period, all these exist in surprising degree in a great majority of schools in this country, and they can be regarded in no other light than as causes of defective bodily deformities." Besides these obvious disadvantages of multiple and improper desks and seats, there is the increased danger of close contact between a healthy child and one suffering from some of the ordinary infectious disorders of childhood, and the unfairness of placing a clean

and healthy pupil at the same desk with a child suffering from some parasitic disease, the result of dirt and neglect.

This leads us to the consideration of the question of the exclusion from school of those pupils who are physically unfit for school and of those suffering from infectious disease or from any kind of disorder liable to be transmitted to other pupils. At the present time, in the absence of any medical officer acting on behalf of the school authority, the position is exceedingly unsatisfactory. The sanitary authority or medical officer of health has, it is true, certain duties and powers in this direction, but they are limited and incomplete. They can of course only be applied to those diseases of which the medical officer of health has official cognisance, *i.e.*, those coming under the operation of the Infectious Disease Notification Act, or when his attention is called to the prevalence of other diseases by the mortality returns or by information derived from the schools themselves. These powers are as follows:—(1) Schools or departments of schools can be closed for a specified time by the sanitary authority or by two members thereof acting on the advice of the medical officer of health, with a view of preventing the spread of infectious diseases, and for the same reason any scholar may be excluded from school. Information with respect to scarlet fever and diphtheria is of course available through the notification to the medical officer of health by medical practitioners, and in Cardiff and most other large towns a considerable amount of the time of the clerical staff of the Health Office is taken up in filling in and despatching certificates to the head teachers of the various schools for the exclusion of scholars from infected houses and subsequently for their return to school after recovery and disinfection. Those of us who have had the opportunity of watching the behaviour of epidemics of these diseases know full well that in most instances the onset may be traced to the attendance at school of unrecognised cases, and that their spread is favoured by the aggregation of large numbers of children at susceptible ages in school buildings. About 80 per cent. of scarlet fever cases occur at school ages. Diphtheria is essentially a disease of school manufacture. The investigations of Shirley Murphy show conclusively that in recent years there has been in London an increased mortality from diphtheria at school ages, as compared with that at all ages, and that the increased incidence of the disease upon the age period, 3–10 years, first became conspicuous in the year 1871, the year in which the Elementary Education Act first became operative. Further the effect of the school vacations was noticed, and it was found that there was invariably a diminution of prevalence corresponding to the vacation period,

and that the age incidence of the cases notified during the vacation altered; that is, the proportion of cases notified at school ages became less during the vacation, showing clearly that there is a greater opportunity of infection at school than at home. The behaviour of diphtheria in London corresponds fairly with that in most large towns and throughout the country. But as far as measles, whooping-cough, and chickenpox are concerned, the first intimation may be the presentation by the teacher of a long list of absentees, and a request for school closure. One of two things then may happen, the Medical Officer of Health may close the school on insufficient evidence, or may keep it open when it should be closed. He has no very exact method at his disposal for obtaining information as to the prevalence of these disorders in any particular locality. Frequently valuable help is obtained in these cases by timely intimation from school teachers. But this, after all, is an irregular, incomplete, and unsatisfactory arrangement; and, indeed, the teachers themselves can only have, for the most part, hearsay and second-hand knowledge of the cause of absence of scholars, derived usually from the reports of the attendance officers, or directly or indirectly from the parents of the absent child: in any case the information thus obtained is unreliable. Moreover, it is not the duty of the Medical Officer of Health to examine or inspect children absent from school on account of illness, and he has no power to do so. The position of a medical officer appointed by the Education Authority would in this respect be quite different. There are in addition several other affections which render a child more or less unfit for school life, such as chorea, contagious ophthalmia, errors of refraction, adenoid growths, pediculosis, ringworm, itch, tuberculosis, etc. The attendance at school of children suffering from these disorders is by no means unknown, and under the existing conditions can hardly be avoided.

We are all, I think ready to admit the possibility of injury, both to the child affected and to others, by school attendance in these cases, but as yet no comprehensive step has been taken to cope with the difficulty. With respect to one of the above-mentioned disorders, the Board of Education has done something: it has given advice. In 1901 the Board issued a memorandum addressed to managers and teachers of public elementary schools, calling their attention to the serious consequences which may result to the eyesight from the neglect of contagious ophthalmia, and recommending that teachers should be watchful with regard to this matter and exclude any child that is affected, taking care that he shall not be readmitted without a medical certificate of fitness. The

Board remarks further, "That in the matter of diagnosis the school authorities are confronted with a difficulty owing to the fact that a large proportion of the cases require special skill for their detection, and hence, unless expert knowledge is brought to bear, it is only too probable that many will be overlooked, to the detriment of children who may be subjected to unjust censure and punishment, as well as to the overtasking and further deterioration of the sight." Undoubtedly the local education authorities are confronted with a difficulty; a diagnosis of a clinical condition is expected, but there is no one to make it. The Board, however, ventures to make a suggestion for overcoming this difficulty, and finally remarks that "It is exceedingly pleased to learn that in one or two large cities a nurse is employed for this purpose," not, however, by the school authorities, but the Board believes that it is by voluntary associations, and that the school authorities may, if they like, take advantage of the nurse's services. Now, notwithstanding the many advances which have in recent years taken place in the status and education of the trained nurse, it is, I think, undesirable that she should be called upon to diagnose disease. Her training as yet has not that object in view. In most large cities and towns there are highly qualified specialists to whom the education authority could appeal. The visitation of schools, especially the infant departments, by suitable nurses, has many advantages, but its adoption by voluntary associations in one or two big towns does not in any way meet the case or relieve the education authority from its responsibility.

Assuming, therefore, that an improved system of medical supervision and sanitary control over schools is necessary, by what machinery can this be effected? Details must of course differ according to local conditions. A method which could perhaps be adopted with advantage in large towns might be unsuitable in smaller districts. A plan which works well in London might not be applicable to a town with two or three hundred thousand inhabitants. In this matter we must proceed with caution. Too much sanitary zeal and enthusiasm might defeat the object in view, and produce opposition and antagonism where co-operation and assistance are essential. A system of over-inspection by medical men armed with inquisitorial powers might produce a panic and seriously interfere with the discipline of the school. Undoubtedly the changes in administrative methods brought about by the new Act should greatly facilitate improvements in the direction indicated, and we have every reason to anticipate a bright future of gradual and important reform. A useful lead has already been given in the recent Report of the Royal Commission on Physical

Training (Scotland), which contains, amongst many other important conclusions, one to the effect that it is desirable that all schools should be under regular medical inspection. This, as Dr. Kerr has pointed out, is "the first official recognition of the necessity of medical knowledge and supervision in education."

Whatever system may be adopted it is in my opinion essential that there should not be two organisations having the same object. A dual authority concerned with the sanitation and medical inspection of schools would mean inefficiency and unnecessary expense. The practical unification of the educational and sanitary authority renders such dual authority unnecessary. I am not prepared to suggest that the medical officer of the sanitary authority should in all cases act as medical officer to the education authority. But in most large towns in which the health department is well equipped, a certain amount of medical supervision of schools is already exercised by the medical officer of health and the Public Health Acts and the Education Codes confer powers and duties upon that officer.

It is now his duty to inspect the schools in his district, but the action he can take as the result of this inspection is limited in the way I have already indicated. What is required in most cases, therefore, is the development and extension of the powers and duties already possessed. In large towns it is obvious that the medical officer of health could not himself undertake anything like a complete and systematic medical inspection of schools and school children. In some special cases, moreover, this work would obviously be more efficiently performed by specialists. His services should, however, be at the disposal of the educational authority for the purpose of advising upon the formation of a suitable scheme of medical inspection and supervision and for the general organisation and direction of the administrative details involved.

In conclusion I would quote the following from a very excellent leading article in the *Lancet* of 9th April:—"After May 1st the education of the whole country will be in large measure entrusted to authorities who have for many years been concerned, at least in some degree, with the public health, and who now have to deal in addition with public education. It is the primary duty of the education authority to teach the children something by which they may obtain the means to live: it is one of the duties of the sanitary authorities to teach the people how to live. It is therefore reasonable to hope that the sanitary authorities will not, in discharging their educational functions, lose sight of the functions for which they were established. There is now before the County Boroughs, and to some extent before the District Councils of this country, an

opportunity for work in a national and imperial sense which has never been equalled in their histories. They have now an opportunity of eclipsing, in a public health sense, all previous records."

DR. HOWARD JONES (Newport, Mon.) stated that the large amount of money spent in this country in the attempt to educate children under five years of age was absolutely wasted; in fact, more or less permanent injury both to the health and mental aptitude of children was thus caused. This country was spending £1,280,000 annually on what was called the education of infants under five years of age. This sum he thought might be advantageously spent upon higher education, and medical inspection of schools and school hygiene. The school accommodation taken up by infants at present would be set free, and the necessity for spending money upon new schools obviated for some years to come, except in new districts unprovided for. He also referred to the great prevalence of measles and its high death-rate, etc., as being in a great measure due to the attendance at too early an age of children at school. The cleansing of schools was not what it should be. The floors, etc., were swept daily, and once every two months or so scrubbed out. The use of oil on the floor would, in the speaker's opinion, be a great improvement, as it would keep down the dust.

DR. HERBERT JONES (Hereford) referred to many instances in which school buildings had been built from plans approved by the Board of Education, but which were at variance in many particulars with the model suggestions of the Board. In connexion with these suggestions he pointed out that although lavatories and water-closets were recommended, no suggestion was anywhere made that water should be provided, either on the premises or within a reasonable distance, and stated that when he had called the attention of school managers to the absence of water from school buildings he was told that there was no regulation of the Board of Education requiring a supply to be provided.

DR. PATERSON (Cardiff) agreed with what Dr. Howard-Jones (Newport) had said as to the attendance of very young children at school. He thought that it would be very much better if the money now spent in attempting to educate very young children were spent in the establishment of gymnasia for schools. This, Dr. Paterson contended, could be done without any addition to the rates. The need for physical training in this country was very evident from the fact that of the number of young men from our towns who joined the army, a high percentage were rejected as unfit on medical examination, and of those who were accepted a large number were subsequently discharged as unfit for further duty.

DR. MEREDITH RICHARDS (Croydon) thanked Dr. Walford for his practical and well-timed address. It was most important that the new education authorities should have their attention directed to the opportunities afforded them for

improving the health of the next generation. He hoped that when ventilation was considered the necessity for raising the standard of floor-space in older schools would not be forgetten; many of these had only eight feet per child, though ten feet was obligatory in more recent schools. The medical supervision of school children was an exceedingly difficult problem. In his own district all cases of suspected communicable disease were reported to him. Most of these cases were visited by a woman health visitor (of whom Croydon had three), and efforts were made to induce the parents to seek medical advice. In the case of measles and whooping-cough, a leaflet was left at the house and its contents explained to the parent. "Swabs" were taken for bacteriological examination in nearly all cases of sore throat, either by the doctor in attendance or by one of his staff if there were no attendant. In this way many cases of ambulatory diphtheria were brought to light. With regard to furniture he imagined that the objection of the Board of Education to single desks was based on economy. Dr. Kerr's suggestion of continuous desks with single seats largely met the difficulty. He had some small experience of oiled floors. In a general office the process seemed to have lessened dust, but in a hospital ward it was very unpopular, as nurses found their dresses were stained by the oil.

Dr. Tatham Thompson (Cardiff) said that from three to five per cent. of the children attending school suffered from defective eyesight. The percentage increased right up to the university, when it was between twenty and forty per cent. Children generally were born long-sighted. It was in learning to use their eyes that the mischief was done: too close a vision and faulty illumination. The proper distance of the writing from the eyes should be not less than 14 inches, but if the "differenco," that is, the distance between seat and desk, is great, so will the tendency for too close vision exist. On the other hand, the "distance" between form and desk in the horizontal plane is of extreme importance, for as the distance is greater so the body will fall forward for the arms to reach the paper, and the head will drop. For the erect position the "distance" must be nil, or better still a negative one of at least 2 inches. In other words, the front edge of the desk should overhang the front of the seat to the extent of 2 inches. If that is not done the child will try to slide forward on the seat, and lose proper support, being only perched on the edge, and the thighs having nothing to rest on. Another important point is the *height* of the form or seat. It should exactly equal the distance from the popliteal space to the sole of the foot, so that with the leg bent at the knee as a right angle, the foot can rest on the floor or foot-board. If not, the legs will dangle and tire, and the child will slip forward so as to rest the feet on the tips of the toes. The *absence of any back support* is another important point—without it a child will soon tire and cease to sit upright. The support should extend at least to the loins. Probably the next important factor in causation of defective eyesight is that of *imperfect*

illumination—it must be remembered that light decreases as the square of the distance, and that except in specially-constructed rooms there is necessarily a great variation in the amount of light available in different parts. In private houses I fear far too little attention is paid to this point, and it is beyond a doubt that the seeds of myopia are often sown in the lack of care in seeing that proper light falls on the lesson book. You all know that it is a common thing to see children squatting or lying, book on lap or on the floor, sometimes in such an attitude that one eye is considerably nearer than the other, and even with no more illumination than the flickering fire-light. Undoubtedly well-diffused daylight affords the best of all illuminants, and that in early lesson life, artificial light should if possible be avoided. If that is impossible, electric light or gas jets, well protected from draughts, to avoid fluttering, are the best substitute. Great care should be exercised in the colouring of the walls, so that the light should be diffused as much as possible. It might be convenient to parents to have their children under five at school, but educationally it was of no value. Single desks were an absolute necessity, and these should also be adjustable. The use of slates and slate pencils he condemned in a most emphatic manner, and also the slant writing, which he contended was conducive to defective eyesight and curvature of the spine. *Home lessons* are the bane of our present educational systems. It is no uncommon thing to find a child doing six or seven hours almost continuous school work expected to spend two or three hours over home lessons; then, moreover, under the worst possible conditions, when the mind and body are already fatigued, when no teacher is near to correct improper positions of attitude, and often with the aid of most imperfect illumination.

MISS KATE HURLBATT (Aberdare Hall, Cardiff) said there was something radically wrong in the management of girls. Many entered college with defective teeth, impaired digestion, weak eyesight, anæmia, and headache. The value of fresh air was not recognised by parents. It was most important that as much time as possible be spent in the open air in order that real intellectual work could be accomplished.

DR. D. J. THOMAS (Merthyr Tydfil) said the adaptation of the older schools was one of the most pressing problems. In Wales they would have to depend mostly for their ventilation on natural methods. In very few districts would it be practicable to urge mechanical ventilation. It was admitted, that in naturally ventilated buildings, ventilation depended largely on diffusion, and owing to the slight power of diffusion which the spiro-toxins possess, the atmosphere became unwholesome at the end of an hour or so. To remedy this defect, the rooms should be emptied twice each morning and once in the afternoon, so as to flush the building with fresh air. To accomplish this object in all kinds of weather and without an undue interference with the teaching arrange-

ments, two conditions must be fulfilled; a central hall or a covered playground must be provided for each school, and the large class-rooms which are now a feature of the older schools must be abolished, smaller ones being substituted with a separate and independent entrance to each class-room from the central hall or playground. The smaller class-rooms would have other advantages: less strain would be placed upon the teacher's voice, and a better system of heating could be devised than the closed stoves which are at present in vogue.

DR. T. H. MORRIS (Chairman, Glamorgan County Education Committee) said that the greatest brake on the progress of education was the Board of Education in London, and if any of those present could suggest any means whereby that body could be made alive to its responsibilities a great deal of good would be done.

DISCUSSION ON

FOOD AND MEAT INSPECTION.

Opened by Col. J. LANE NOTTER, R.A.M.C., M.A., M.D., D.P.H.
(FELLOW),
And W. HUNTING, F.R.C.V.S.
(FELLOW),

At Sessional Meeting, April 30th, 1904.

COL. J. LANE NOTTER.

THE systematic examination of meat and other food supplies is one of the most important duties devolving on sanitary authorities, and one too, which has for some time past engaged the serious attention of The Sanitary Institute. The report of the Royal Commission appointed to inquire into the effect of food derived from tuberculous animals clearly indicated that the danger is a real one, especially with regard to the meat of tuberculous bovines. The report was issued in 1898, and the Council of The Sanitary Institute at once acted on the suggestions therein stated, and established an examination test for candidates for the office of Inspector of Meat and other Foods; they formulated a syllabus for this examination which made the course of study and instruction as comprehensive and as practical as is possible, and they are indebted to the veterinary profession for the loyal support they have given them in carrying out this important duty.

Much misconception exists in the public mind as to what constitutes unwholesome meat, it being commonly held that meat of diseased animals is alone unwholesome, whereas, in truth, the possession of poisonous properties can be more distinctly traced to the putrescent state of meat from healthy animals than to the fresh meat of diseased animals, unless when the flesh happens to be infested by dangerous parasites. As the meat of diseased animals usually decomposes rapidly, it is not improbable that in many of the recorded cases of supposed meat poisoning, the effects attributed to the virus of the disease were really due to the putrescent condition of the food.

The advantages of a meat diet are: the large amount of nitrogenous substances, the union of this with much fat, the presence of important salts such as chloride, phosphate and carbonate of potassium, and iron. Meat is also easily cooked and is very digestible; it is probably more easily assimilated than any vegetable, and there is much more rapid metamorphosis of tissue in carnivorous than in vegetable feeders. The great disadvantage of meat is the want of starch.

The actual composition of meat is as follows:—

	Rump of Beef.	Shank of Mutton.
Water ...	74·2 ...	71·9
Proteids ...	22·0 ...	18·8
Fat ...	2·2 ...	8·3
Ash ...	1·6 ...	1·0
Total ...	100·0	100·0

Bone forms about 20 to 25 per cent. of the meat as sold. It is relatively more in young animals; in veal it constitutes as much as 30 per cent. Bones contain a large amount of nutrient matter, a considerable part of which is extracted by boiling, and more could be obtained if the bones were crushed. The following is the composition of beef bones:—

Water	12·1
Proteids	24·5
Fat	11·0
Ash	48·6
Loss	3·8
Total	100·0

Of these proteids nearly one-half (10·3 out of 24·5) are digestible.

Bones make a most palatable soup and may be made to yield an important addition to the useful proteids.

Good and wholesome beef or mutton should exhibit the following characters:—

1. It ought to be pale, slightly brownish, neither pale pink on the one hand, nor deep purple on the other. If pink, disease is indicated; and if purple, the animal has probably not been slaughtered, but has died with the blood in it, or has suffered from some acute fever.

2. It should have a marbled appearance from the ramifications of little veins of fat among the muscles.

3. It should be firm and elastic to the touch and should scarcely

moisten the fingers. Bad meat is usually wet, sodden, and flabby, with the fat looking like jelly or wet parchment.

4. It should have little or no odour and not a disagreeable one; for diseased meat has a sickly, cadaverous smell. Any disagreeable odour is most easily detected when the meat is chopped up and drenched with warm water.

5. It should not shrink or waste much in cooking.

6. It should not become soft or wet on standing a day or so, but should on the contrary dry on the surface.

The diseases of cattle which the inspecting officer should watch for are, (1) *pleuro-pneumonia*; (2) *foot and mouth disease*; (3) *cattle plague* or *rinderpest*; (4) *anthrax*; (5) *tuberculosis*; (6) *actinomycosis*; (7) *dropsical affections* from kidney or heart disease. A great number of other diseases attack cattle which it is not necessary to enumerate. The presence of *Tænia mediocanellata* cannot be detected before death.

The diseases of sheep are similar to those of cattle; sheep also suffer in certain cases from splenic apoplexy or braxy, which is considered by Professor Gamgee to be a kind of anthrax. Of the chronic lung affections from which sheep suffer, one of the most important is the so-called phthisis, which is produced by the ova of the *strongylus filaria*. This entozoon has not yet been found in the muscles and the meat is said to be good. The rot in sheep is caused by the presence of *distoma hepaticum* in the liver, and sometimes, too, by other parasites. The animal is supposed to take in *cercaria* (the embryotic stage of *distoma*) from the herbage.

The pig is attacked by anthrax in different forms, by tuberculosis, by muco-enteritis and by hog-cholera. The condition of the flesh is in most cases like that produced by septic disease, and it is unfit for human food.

The so-called measle of the pig, caused by the presence of *Cysticercus cellulosæ*, and the disease due to the *Trichina spiralis*, render the meat unfit for food.

Diseases caused by Meat.—The flesh of apparently healthy animals may produce poisonous symptoms; the eating of the flesh of the pig sometimes causes diarrhœa; no doubt the flesh is affected by the unwholesome garbage on which the pig feeds; in these cases the actual cause has not been isolated.

The flesh of healthy animals, when decomposing, often gives rise to vomiting, purging, diarrhœa, and great depression. Cooking does not appear entirely to check decomposition. The expulsion of the noxious food from the body generally results in speedy recovery, but the old and infirm may sink from exhaustion.

Sausages, pork-pies, and beef-steak pies sometimes become poisonous from the formation of a ptomaine. The symptoms are severe intestinal irritation, followed rapidly by nervous depression and collapse. Neither salt or spices hinder the production of this poison. The meat most likely to be affected is that stored in dark, damp, unventilated places, to which ground-air can gain access. Under these conditions the development of poisonous properties in the meat is largely increased.

And here I may observe on the absence of proper places for the storage of food, not only in the working-class dwellings, but even in the better class houses of the present day. Any dark unventilated corner for a pantry is considered to be sufficient provision, and a well-constructed and ventilated larder is not considered in the construction of these houses. There is no part in the construction of a dwelling of more importance than the provision of a proper place to store food, and yet the condition of many flats in London shows how totally indifferent are those who erect such dwellings to the necessity for such places. It would indeed appear advisable for the County Council to enact a by-law insisting on the provision of a proper larder in all dwellings.

The flesh, and not only the decomposing flesh, of diseased animals causes in many cases injurious effects. The probability now is that the effect of diseased meat will be found to be more considerable than was formerly believed.

At the same time we must not go beyond the facts as they are at present known to us, and at present certainly bad effects have been traced only in a few instances; perhaps the heat in cooking is the safeguard.

Meat is not apparently altered in the *early stage* of acute inflammatory disease, and it is said some of the best meat is taken from beasts in this condition; it is not known to be injurious, but the blood should be allowed to flow entirely out of the body and not be used in any way.

It is now accepted that *tuberculosis* in cattle cannot exist without the tubercular bacillus having been the exciting cause. Certain predisposing conditions may be present in the case of all animals, such as malnutrition, bad ventilation, damp soil, hereditary disposition, etc. The bacilli gain access to the body, either by inhalation of contaminated air, by inoculations or by ingestion of food containing the specific organism or its spores. These when swallowed adhere to the mucous membrane of the different organs, and they may then undergo further development; from the mucous surfaces they pass into the surrounding tissues and to the lymphatic glands, which largely become affected; after them the serous membranes of the abdomen and of the thorax are the most frequent seats

of the disease. Cattle, pigs, poultry, and rarely sheep, are all liable to be affected with tubercle, but it is in cattle, and more especially in milch cows, that tuberculosis is met with.

The organs most frequently affected are the lungs, liver, kidneys, and brain, and in the cow the udder. In cattle localised tuberculosis is the exception. The muscles appear to be rarely affected, although tubercle bacilli have been found in the expressed juice, which had infective properties; they have also been found in the blood and in the secretions of diseased organs.

In tuberculosis there may be no visible symptom of the disease in the animal, unless in the case of an acute attack, in which there is always fever and rapid wasting of the body.

When the disease attacks the external organs such as the udder, there is little or no constitutional disturbance; this is much more likely to occur when the internal viscera are affected, so that the animal may be extensively diseased and yet exhibit no symptom to call for special attention.

The question of the use of flesh of tuberculous animals has been much debated. From the nature of the case there is great difficulty in obtaining direct evidence of the transmission of the disease from animals to man. According to the experiments of Kastner, infection is not to be feared except in those rare cases in which tubercles are found in the muscles. On the other hand, experiments by Steinheil show that tuberculosis could be transmitted to guinea-pigs by administering the expressed juice from flesh in which no tubercles could be found.

Dr. Sidney Martin's evidence in particular before the Royal Commission on Tuberculosis (1898) shows that a great difficulty exists with regard to meat, inasmuch as a number of butchers are very careless in the cutting up of carcases partially affected with tuberculosis. Matter finds its way to the knives used, and this is transferred to joints which would otherwise remain untainted. Roasting before a fire was the least and boiling the most effective method of cooking the flesh. All evidence appears to show that when tuberculosis is present and well defined and when the glands are involved the flesh should not be eaten.

The recent outbreak of anthrax in Cheshire shows that this disease is one that calls for inquiry. It is well known that horse-hair and wool is imported into this country from Mesopotamia, Russia, and Asia Minor, and is received in a filthy condition; it has been the direct cause of woolsorters' disease to many operatives engaged in wool and hair factories. Up to very recently, and not, I believe, in all cases even now, has any general practice of disinfection been carried out, and the refuse

from the factories has been used as manure on account of its high fertilising properties. In this way outbreaks have taken place among cattle, etc. The facility with which anthrax can be communicated by actual contact with matter impregnated with the virus and the great rapidity with which putrefaction sets in after death proves that however good the meat may appear to be, it should be unhesitatingly condemned and destroyed, if evidence of the existence of anthrax is forthcoming.

Epidemic pleuro-pneumonia is a disease peculiar to the ox, and is a contagious inflammation of the lungs and pleura, but it has never been transmitted to other than bovine animals; its effects are localised in the lungs alone, and even in these organs the disease is a limited one. The rule has been to pass the carcases of animals slightly affected with pleuro-pneumonia as marketable and innocuous, if they present no departure from natural conditions.

Actinomycosis has been transmitted from cattle to cattle by inoculation; the jaws are usually the part affected. The most generally accepted view now is that the natural habitat of the ray-fungus is on the cerealia, that it lives on these parasitically, especially upon barley, and from these enters the animal's body through wounds, abrasions, etc.

As regards the preservation of meat we know that the blood and flesh of healthy animals are free from bacteria, but, on the other hand, the contents of the digestive tract are extremely rich in microbes.

If the carcase of a slaughtered animal be left without being disembowelled, the saprophytes will make their way through the capillary vessels of the intestinal wall into the general circulation, so that the entire carcase quickly begins to undergo decomposition. This can be prevented by the early excision of the entire length of the alimentary canal; and if this be practised the remaining flesh will be perfectly free from fungi. Any subsequent danger can only be due to gradual penetration from the surface. Since these sources of bacterial infection cannot be entirely cut off, attempts are made to prevent the increase of these parasites in the flesh. The oldest known remedy is cold, but the temperature must be kept several degrees below zero. The freezing of meat does not kill the germs present, but only hinders their development. If meat is not stored at a low temperature, but merely put in the ice-chest whereby it only attains a temperature of 0° C., an increase of germs ensues. These cold-supporting organisms produce the disagreeable taste and smell acquired by edibles remaining in the ice-chest for a few days. Actual putrefaction is not produced by these bacteria. Food-stuffs should not be brought into actual contact with natural ice, since this substance contains not only

putrefactive organisms, but also, under certain conditions, pathogenic organisms.

Frozen meat, when thawed, undergoes rapid decomposition, because the cellular tissue is loosened by freezing, and access to the interior is facilitated for any organisms present on the surface.

In dried and salted meat the development and activity of the organisms can be prevented by depriving them of the water necessary for metabolism. In salting and pickling it is only the hygroscopic power of the salt which comes into play; the germs are plasmolyzed and their activity so prevented. Tubercle bacilli are not killed by a concentrated solution of salt after two months' and typhoid bacilli after three months' action. Smoking forms a more reliable means of preserving meat, the active agents being the vapours of phenol, creosote, etc., present in the smoke. These antiseptics do not penetrate far into the flesh, therefore smoking can only preserve the fresh meat from healthy animals.

Milk.—By treating milk to a temperature of 60° C. for one hour, to 75° C. for ten minutes, and to 95° C. for one minute, tubercle bacilli if present will certainly be killed. Cholera and typhoid organisms are less resistant and are killed more quickly than tubercle bacilli at the above temperatures. Only a single pathogenic species can withstand the short boiling to which milk is ordinarily treated in domestic management, and this is the anthrax bacillus containing spores. The danger from this source is remote, as the microbe does not form spores within the animal body. Even in the worst cases, therefore, only vegetable forms, easily destroyed by boiling, can find their way into milk from the body of the cow.

The lactic acid bacillus, always present in unboiled milk (to which the souring of milk is due), is easily destroyed by heat; but the *bacillus mesentericus*, often found in it, forms spores, which are not destroyed by ordinary boiling and germinate when the milk is kept at a moderately warm temperature, producing a brisk fermentation whereby a large volume of gas is liberated. The fundamental idea of Soxhlet's method for sterilizing milk is to boil it for forty minutes in small bottles, holding just enough for one meal, and closing the same with an impervious stopper which is only removed just before use. Milk so treated will keep at the ordinary room temperature, as the spores of the *B. mesentericus* do not develop below 15° C.; but if it is introduced into the alimentary canal of a child, the spores will rapidly multiply, and in such cases large quantities of gas, giving rise to flatulency, will be formed, and possibly also poisonous decomposition products of albuminoid matter. To render milk

sterile in the strict sense of the word it is necessary to raise it to a temperature of about 120° C. for twenty minutes.

Under these circumstances the lactose decomposes into dark-brown fission products, the fat loses its emulsified condition and separates out as cream, which cannot be made to diffuse again even by shaking, and the proteids are converted into a form very difficult of digestion.

In short, there is at the present time the greatest difficulty for freeing milk on a large scale from germs without at the same time seriously prejudicing its flavour and nutritious value.

Since, then, the destruction of hardy germs is so difficult, the greater care should be taken by washing the udder, hands, and milk vessels, to secure extreme cleanliness in the preparation of milk intended for infant consumption.

Sterilization then becomes an easier task, the milk drawn under these conditions being very poor in spore-forming bacteria. It is imperative that the cream destined for butter-making should be free from pathogenic organisms. The organisms of cholera, typhoid fever, and tuberculosis present in butter retain their vitality for a long time.

As butter is consumed in the raw state, a reliable preliminary treatment of the cream is in the highest degree desirable. Schuppan has shown that it is possible to produce good butter from pasteurized or even sterilized cream, and Weigmann introduced the plan of artificially souring cream by means of pure cultures of *B. acidi lactici.* Boracic acid, salicylic acid, and even benzoic acid have been used as milk preservatives. The influence of small doses of boracic acid is still a moot point. One objection to allowing boracic acid to be added to milk is that it enables the milkman to palm off stale milk as fresh. It would, therefore, seem advisable to prohibit chemical preservatives altogether. In condensed milk many of the bacteria present are killed by the preliminary heating and the subsequent concentration at 50° C to 60° C. A few survive and are still alive in the finished product, but not in a condition to do any damage, since the high concentration plasmolyzes the germs, retarding their development and so preventing decomposition.

W. Hunting.

LEGISLATION has recognised the necessity for inspection of food of all kinds, whilst the seizures of bad food and the penalties inflicted on the vendors which are recorded daily in our newspapers, show that there is still much to be done in protecting the public health. Persons

engaged in the meat-trade frequently resent the action of inspectors, not always without cause. The protection of the public should not be irreconcilable with the interest of honest dealers, and increased strictness of inspection might well be attained without any injury or annoyance to these men. The great offender is not the reputable dealer, but the odd man who is ever ready to make a profit on material that no respectable tradesman would touch. Even a man of good standing may sometimes find himself in trouble through the carelessness or ignorance of his servants. It is also possible that men may be unjustly convicted for an alleged offence through the error of an inspector. The changes which convert good food into bad are sometimes not evident to the uninstructed, and sometimes are matters of degree, upon which two opinions may honestly exist.

The requirements of an Inspector of Foods.—An inspector should be not only a man of natural intelligence, but one possessed of technical training. At the present time there are inspectors wanting in both these requisites. Their actions are accompanied by hardship to honest traders, and encourage opposition to the carrying out of the law. Food-inspectors should supply some evidence of their efficiency, and the simplest method of doing so is the production of a certificate from a recognised authority stating that they have been tested and found capable. The Sanitary Institute now grants such a certificate, and holders of it should be preferred when local authorities are selecting candidates for the office of food-inspector.

The whole reason for the inspection of food is the protection of public health, and therefore with the medical officer of health must always be the ultimate decision of what is fit or unfit for human consumption. It is obvious that his other duties must prevent him from giving direct attention to all the details of food-inspection, and that he must have special officers to assist. To the sanitary officers, then, fall the duties of meat-inspection, and whenever doubt arises, or the law requires, the medical officer must be called in to advise or condemn. It cannot be expected that the sanitary officer should be a trained pathologist capable not only of detecting changes in food, but also of recognising their exact nature and qualities.

Most of the ordinary changes he should be able to detect at sight, with knowledge of their nature, but in some his power to detect will not be accompanied by exact diagnosis of the nature of the change, and then he calls upon his chief to decide.

To no one are the pathological changes which take place in domestic animals so well known as to properly-trained veterinary surgeons. The whole course of study and clinical experience of veterinarians is devoted to

this subject, and I venture to claim for them pre-eminence in the work of meat-inspection. Their attainments should be utilised, and when circumstances supply full scope for their powers and fair remuneration for their services, as is the case where large public abattoirs exist, I hold that the meat-inspection should be entrusted to them. There need be no conflict between their duties and those of a medical officer. All that is necessary is that an agreement should be come to as to what is fit or unfit for human consumption, and the veterinary inspector's decision may then be accepted.

The Difficulties of thorough Meat Inspection.—Outside of a public abattoir meat is distributed over private slaughter-houses, butchers' shops, and various factories where it is prepared for food in different forms. Thorough inspection should cover all these places, but we know that many escape notice altogether, and some receive only very irregular visits.

Then there is the facility with which meat may be moved by road and rail and delivered to unknown places. Owners of live stock have not yet distinguished between what is fit or unfit for food, and they have a not unreasonable desire to salvage all they can. Cows that appear to be approaching death from some disease are treated in the same way as those that suffer from a broken leg. Nearly every village contains a handy man who combines general dealing with horse and cattle slaughtering, and who is ready to dress and purchase the dead or dying animal. The resulting meat is sent to the nearest large town, and as often as not escapes inspection. Even the heavy penalties inflicted by the City of London Courts do not deter men from sending all kinds of pathological specimens to the metropolis as food for its inhabitants.

The only effectual method of controlling this irregular traffic is a regulation requiring that all meat sent by road or rail shall be consigned, or taken, to a central place for inspection before being delivered to any private person. All towns should have the power to make and enforce such a regulation.

Every slaughter-house should be licensed, and every person acting as a slaughter-man or dresser or carrier of meat should also be licensed.

What is fit or unfit for consumption?—This question should be answered as closely as possible. Of course, conditions will occasionally arise in which, with the food before them, two men equally capable may hold opposite opinions. The degree of unfitness must sometimes be a matter so fine that disagreement is allowable, but these cases will be few and far between if the general principles are accepted which shall determine what is fit or unfit for human food. Guidance is wanted for the owner of meat and for the inspector, and the men to determine are the medical officers

of health. Some uniformity of action is very desirable if inspection is not to be discredited. It is absurd that meat should be seized in one town which is passed in another. It is still worse when a certain definite condition is called unfit by one authority but fit by another. The methods of meat-inspection should not only be uniform, but the regulations governing them should be general. Imported foods and meats should be inspected as carefully as our home-products. It is obviously unfair to force a standard of excellence upon our meat-producers and dealers, whilst the foreigner is permitted to compete without any restriction whatever. It may be argued that the inspection of a cargo of beef or mutton would be such a tedious and expensive business as to be a hardship to the traders; but inspection need not include the examination of every carcase; every tenth or twentieth would soon determine the quality of a cargo; and the very fact of any inspection being enforced here would increase the rigour of the inspection adopted at the port of embarkation. The suggestion of the Local Government Board that all stripped carcases should be seized is insufficient, some examination of the lymphatic glands should be added.

By way of inviting discussion as to unfitness of meat, I offer a few remarks on some conditions which are believed to be deleterious.

Putrefaction.—This is the most common cause of unfitness for consumption. It is, however, a matter of degree and must be left to the discretion of the inspector.

Emaciation.—As this condition usually depends upon disease, its presence may nearly always be accepted as evidence of unfitness. But when viscera are healthy, and flesh and fat firm, there is no reason to object to mere leanness. I remember three carcases of sheep being seized in Smithfield which I saw during life and while being dressed. Healthier animals I never saw, but they were seized simply as "being too lean."

Inflammations.—A simple inflammation of any part or organ of the body renders the affected part unfit for food, but does not afford reason for condemning the rest of the carcase. Septic and specific inflammations may result in no apparent changes, except those local ones which would entail condemnation of the affected part. Suppuration, when present, is more serious, but may only be local.

When an inflammation has not caused general changes in the carcase, when the flesh is firm and of a good colour, I think it may be treated as a local matter. When the flesh is dark, wet, and soapy to the feel, the whole carcase should be condemned.

Specific Diseases.—The Diseases of Animals Acts have scheduled a

number of the specific diseases of cattle, sheep, and pigs, so that legally, none of these should ever come under the notice of meat-inspectors: they are otherwise disposed of. No doubt many carcases of animals suffering from rinderpest, pleuro-pneumonia, and foot-and-mouth disease, have been consumed by human beings, but no injury has ever been traced to such a proceeding. Quite recently, carcases of cattle suffering from anthrax have been consumed and no trace of injury has been recognised. Pigs suffering from swine-fever are common, and it cannot be doubted that many have been sold for food and consumed without injury.

In all the scheduled diseases seizure should follow detection, because such carcases are illegally offered for sale. Fortunately, the chief contagious diseases of cattle, sheep, and pigs, are not transmissible to human beings, and therefore not likely to do any harm even if the carcase were offered for sale.

Diseases of animals transmissible to man are rabies, glanders, anthrax. and tuberculosis. These, therefore, require some consideration.

Rabies has been stamped out in this country for nearly three years. The danger to human beings from a diseased carcase would be greater to the butcher than to the consumer, but as all affected animals are provided for under the Diseases of Animals Acts, they should be seized. Unfortunately, there are no definite post-mortem lesions, and diagnosis could only be made from a correct history or by means of inoculation from the nervous centres.

Glanders does not affect cattle, sheep, or swine. It is almost confined to equines, but is communicable to man. Horseflesh is so seldom used as food here that we might ignore the disease, save as possibly present in some prepared foods. At present the compensation paid for affected animals renders their use for any purpose outside the regulations of the Diseases of Animals Acts very unlikely.

Anthrax.—This disease prevails widely among cattle and is increasing, according to the Government returns. Although many carcases of diseased animals must have been consumed, and apparently with impunity, there is no disease which is more unanimously banned by all authorities.

Tuberculosis.—Until the positive evidence obtained by some experimenters that bovine tuberculosis is transmissible to man is shown to be erroneous, we must assume that tuberculous carcases are unfit for human consumption. There is, however, a stage of the disease which may be accepted as purely local. In such cases all the unaffected portions of the carcase may be passed as good food. I accept the suggestions of the Royal Commission as to what states of the disease render the carcase fit

or unfit for consumption. If uniformity of action be desirable, the Commission's recommendation should be accepted.

Actinomycosis is a local disease although it may affect more than one part of the carcase. By interference with some important function it may produce emaciation, and the general symptoms resulting would have to be judged as in any other local disease. When the carcase is firm, slight actinomycosis may be treated simply by condemnation of the organ affected, with, perhaps, the immediately contiguous tissues.

Parasitic Diseases.—Very few of the parasitic diseases of animals used for food are transmissible to man. In those which are not, the carcase may be accepted as fit for food, save the special organs affected.

Fluke in sheep and cattle necessitates seizure of the liver, but the carcase is fit for food unless it presents changes due to constitutional disturbance.

Echinococci and other cystic forms of parasite render the affected organs unfit, but do not necessarily spoil the carcase.

Measles in pigs and cattle renders the carcases unfit for sale, although a few days' freezing or thorough cooking prevents any injury to man.

Trichinosis is almost unknown here, but renders carcases in which it exists unfit.

Strongyli in calves render the respiratory organs unfit, but do not affect the carcase unless the disease has been so virulent or long continued as to produce changes in the flesh which are noticeable.

In the larger towns, where abattoirs exist, meat-inspection is very thoroughly done, so far as the abattoir is concerned. But meat may be killed outside the urban boundary and brought in with no certainty of anyone seeing it, save the butcher and his customer. Some kind of clearing-house is needed, through which all meat killed outside the boundary should compulsorily pass.

Probably the most dangerous and offensive meat is used only for manufacture into prepared foods, and therefore these manufactories should be regularly inspected. All places where meat is prepared or sold for human consumption should be licensed and open to inspection.

DR. H. E. ARMSTRONG (Newcastle-on-Tyne) said although he was not in entire agreement with all that had been advanced in the two papers, he was very largely in accord with most of the views expressed by Col. Notter and Mr. Hunting. There were several points not touched upon that he would like to

have seen dealt with. One, for instance, was the question of the Tuberculosis Compensation Bill. Mr. Hunting had given him an opportunity of alluding to the inspection of foreign meat. We received a large quantity of foreign meat in this country, which was fortunate; probably we were going to get a larger supply in the future than in the past, especially, perhaps, from Argentina. It was important, as Mr. Hunting had pointed out, that meat should not be sent from abroad to handicap honest trade here. But the importance of carrying out the inspection efficiently was very great. Dr. Collingridge could speak more authoritatively on this matter than himself. The suggestions which had been thrown out did not seem to meet the difficulty, and the greater the difficulty the greater was the need for trying to surmount it. Foreign meat was sent to us in various conditions; it was, too, all sheeted, and he did not think that the inspections of a carcase here and there among several thousands was an adequate or proper examination of such meat. Because one carcase was good it did not follow the whole cargo was uniformly good. This was assuming too much, but it was the practice to which they seemed to be driven at present. There should be an organisation to go further than that. Offal, for instance, came in boxes, and no information was obtainable as to the prevalence or otherwise of tuberculosis in the carcases to which it had belonged. The foods from the United States came stamped. But the stamp said nothing about the quality of the meat sent. Perhaps it was sent without any examination of the glands having been made. Sometimes the carcases came with the pleura removed. Not long ago there was a case in Newcastle of a carcase from which the pleura had been removed and in which the glands were beginning to undergo changes, only found out upon examination. The flesh was seized and destroyed with the consent of the consignee. The facts indicated a very imperfect way of dealing with such matters. With regard to the rules for the seizure of tuberculous meat, he thanked Mr. Hunting for his very fair exposition. He quite agreed that meat inspection should be under the control of the Medical Officer of Health. He would like to see one uniform method adopted in all towns. That was probably a more difficult thing to obtain than the mere examination of all carcases of beef from America, because opinions varied among Medical Officers of Health. After long experience he was of opinion that the term "tuberculous meat" should be more clearly defined than it is. What is at present so called, is meat with *visible* tubercles on, or in, it; but long before the disease became visible the meat was tuberculous. This fact was well known to bacteriologists, but in the trade it was lost sight of. If that fact were fairly grasped, then the moment a piece of meat became visibly tuberculous to even a small extent, it should be dealt with, because the visible tubercle was the sign of the invisible tubercle or microbe, and was a proof that something had been going on in the tissues and juices of the animal for a considerable time before the visible home of the tubercle bacillus had been built for it. One of the greatest difficulties that beset inspectors and medical officers was that of getting prosecutions, even in cases of very bad meat

sent in from the country, because of some technical point or other. In one instance under his observation the assistant meat inspector and the manager of a sale depot were standing together when a cart arrived with carcases from the country, some of which were good, but one was highly tuberculous. The meat was not actually delivered. The diseased carcase was taken possession of and destroyed, but in view of recent decisions it was considered by the Town Clerk not to be a good case in which to take legal proceedings, although the disease was very extensive. The fact of the meat being found whilst still on the butcher's cart constituted the technical difficulty. Col. Notter had drawn attention to a very important point in regard to the carelessness with which butchers use their knives in cutting up carcases. The speaker made it a duty to try to teach butchers the great dangers they themselves run (not to speak of their customers) in not being scrupulously clean, and to urge them as far as possible to sterilize their knives after use in cutting up tuberculous meat. He thoroughly agreed with Mr. Hunting as to the difficulties of meat inspection outside abattoirs and also to the need of a clearing house.

DR. W. A. BOND (Holborn) said that after being appointed medical officer of health for the Holborn District Board of Works, it was suspected, and he confirmed the suspicion, that a large amount of very much diseased meat was being introduced into that district, meat that was quite unfit for food. There were great difficulties in the way of inspection, because meat was brought into that district very early in the morning. It was practically impossible for officers engaged on day duty to be up at that time. It was therefore essential that a meat inspector should be appointed, and they were very fortunate in securing the services of Inspector Billing, who was no doubt well known to them all. The result was that during the year following the appointment he had to attend various law-courts between 120 and 130 times. He also read a paper before The Sanitary Institute on "Public Abattoirs," and on the great difficulties there were in the way of a satisfactory meat inspection. As far as London was concerned he felt it was necessary to have public abattoirs, which could be supervised by veterinary surgeons, who had more knowledge of animals than a medical officer of health. He quite agreed with Mr. Hunting that uniform standards ought to be laid down, and that medical officers ought to come to some uniform decision with regard to difficult points. He was therefore glad that the Royal Commission on Tuberculosis had laid down general rules for the seizure of tuberculous carcases. Even before the findings of that Commission he had always practically acted upon those lines. Another point with regard to the seizure of carcases was that if there was evidence that the animal had not been properly bled, it should be seized; because in such cases there was little doubt that the animal had been dead or about to die before it was prepared for food. He was glad to hear Dr. Armstrong emphasise the point raised by Col. Notter as to the knives, a point which had also been dealt with in Dr.

Sidney Martin's evidence before the Commission. In connection with anthrax, all refuse from factories should be sterilized before it was made use of for manure. That was a point that ought to be strongly emphasised. Mr. Hunting stated that all places where meat was sold or prepared for human consumption should be licensed and open to inspection. He thought that under sec. 47 of the Public Health (London) Act, 1891, they had ample powers for inspecting meat in all premises in which it was sold or prepared for sale, and there was a similar section in the Public Health Act, 1875, which applied to the whole of England. There was one point in Col. Notter's paper which had struck him forcibly, viz., the question of the provision of proper larder accommodation. That was so important that he would suggest that it be made the subject of a special resolution of that meeting, and if no one else proposed it, he would be happy to do so.

Dr. T. Whiteside Hime (Bradford) said he was glad to bear his tribute to the great value and importance of the papers that had been read, and he trusted it would not be considered out of place if he ventured to differ from Col. Notter and Mr. Hunting on one or two points, and that his criticism would not be taken as implying any lack of appreciation of the value of their contributions to subjects brought forward by them. Mr. Hunting had commenced with the statement that the legislation of the country dealt with all kinds of food. He wished it were so; but there was one important article of food which was not affected by the law, because the law had taken the trouble to exclude it specifically, and that article of food was water, one of the prime necessaries of existence. For some inscrutable reason water had been excluded from food legislation. The interesting points raised by Col. Notter and emphasised by Mr. Hunting in regard to putrescence ought to be laid to heart by all, especially by those wishful to become inspectors, because these points were usually very much lost sight of. The tendency was to hunt for the presence of one of the specific diseases, such as tuberculosis or anthrax, of which there might be no evidence, the decay and putrid condition being regarded as of little or no importance. There was one noticeable and very remarkable difference between the two papers that had been read. Col. Notter seemed to have directed his attention more particularly to the scientific aspects of the question under consideration, and to high and rather fanciful ideals. Col. Notter considered that meat is not fit for use under various conditions, which Mr. Hunting considered should not prevent meat from being passed as fit to be consumed. Here were two authorities at variance, without any question of getting a legal verdict being raised, or any possibility of suggesting prejudice. The evidence upon which a great deal of meat was condemned as being unfit for food was often dependent on the feeling, or prejudice of the individual. When a question of degree arose there would unavoidably be difference of opinion in some cases. But where there was scientific evidence of facts, mere opinion should not decide important questions. For

instance, it was considered desirable in nearly all cases to condemn the carcases of animals drowned, or had suddenly died, or had not been properly bled. He did not think that any sufficient grounds had been advanced to them for that procedure, or proof given that such meat was unfit for food. It was on account of the condition of the meat, and not on account of the violent death that it should be passed or condemned. If the meat was bad it should be condemned, and if good it should be passed, regardless of the mode of death. Or to take another instance, the condemnation of a whole carcase because there had been found some animal parasites in the intestines, which are wholly incapable of living within the human body. That was not altogether a rational proceeding. Mr. Hunting took the same view as he did, the other view was not supported on any ground. Take for instance *pâté de fois gras*, a relish derived from a diseased condition of the liver, and often artificially produced by subjecting the animals to unnatural and unhealthy conditions of life. That was eaten all over the civilised world, and no one had ever suggested that there was any danger in that delicacy. He could not see any sound reason for supposing that the presence of intestinal worms in animals, which could not develop in the human being, should be regarded as a reason for condemning the carcase of the host. If the host had suffered in health from the long continuance or great number of the parasites, then the unhealthy carcase should be condemned. Col. Notter made reference to a matter to which he thought attention ought to be prominently drawn all over the country, the condition of pork. The pig, as a rule, got nothing but food of the most stinking character, and though naturally a cleanly animal was obliged to live in filth. It was highly desirable that general attention should be directed to this subject. Could the flesh of animals born in filth, fed on filth, and reared in filth be regarded as wholesome and good? He doubted it. He did not know whether any legal power existed whereby medical officers and inspectors could interfere in this matter, but there were a great many things in this connection in which action could be taken with advantage, and much could be effected, even where there was no legal power to act. By advice and assistance the public officers might do a great deal to assist towards securing better conditions of keeping, feeding, and fattening pigs. It was to be regretted that time prevented the speakers referring to other kinds of food. Of course, the most important question of all was the vexed one of tuberculosis. Col. Notter used a very sweeping phrase when he stated in his paper that "All evidence appears to show that when tuberculosis is present and well defined and when the glands are involved the flesh should not be eaten." He ventured to take very great exception to that statement as to what "All evidence" shows; in fact, he did not know where the evidence referred to as warranting the alleged conclusion existed. He would recommend every student to study for himself the Report of the last Royal Commission and see for himself what evidence there was. The remark as to "tuberculosis being present and well defined," he did not think meant anything whatever,

because if it was present so as to justify condemnation, it must be "well defined" and clear and obvious to the eye. As to "the glands being involved," did that mean that the whole carcase was to be destroyed if there were one or two glands in the whole body affected? As the statement stood in Col. Notter's paper, it was so. He doubted whether Col. Notter could have meant that; if he did then Col. Notter differed on this point from all other distinguished authorities. As they might know, the Local Government Board did not hold that view, and had issued a set of model by-laws in which it defines conditions in which it is quite right and proper for the sanitary authority to pass carcasès where tuberculosis is present, and which are practically identical with the rules in force all over the Continent and in America. He believed that every medical officer in the country, except one or two very extreme men, adopted those rules in practice, though, unfortunately, these model regulations did not seem to be formally adopted as by-laws. He thought that no medical officer in the country adopted what seemed to be Col. Notter's rule that if "glands were involved" the whole carcase must be destroyed, what the French call "*saisie totale.*" No government in the world sanctioned it. Take the everyday experience in hospitals. Operations were performed on persons with tuberculous glands of the neck; they were removed, and the wound healed up, and the patients returned to a perfectly healthy and normal life. Yet they were asked to believe that because a gland in an animal was infected, the whole carcase was infected with tuberculosis and must be condemned. No person of authority believed that. It was not the view of army medical officers, nor of the Royal Commission, nor of the Local Government Board; nor was it the practice of medical officers or inspectors throughout the country generally to act on it. Dealing with foreign countries, he pointed out that the inspection of butchers' meat is carried out in some of them with a degree of care and by means of officials who have undergone a system of scientific training that is unusual in this country. He thoroughly endorsed the view that had been advanced as to the necessity for having only well trained and carefully educated meat inspectors, that men should be thoroughly qualified before they undertook to exercise the tremendous powers they possessed under the Public Health Acts to interfere with private property, ruining possibly not only a man's trade but also his character. The powers were very large, and ought only to be entrusted to persons of considerable special knowledge and large experience. He was not referring to the large cities where the medical officers were trained men and gave their whole time to their duties and generally had well-trained inspectors under them, but to the great area of the country where inspectors had to fill up their time with many varied functions, in fact, all imaginable duties, and medical officers got a few pounds a year for casual attention to the very responsible and im-portant powers they held under the Public Health Acts. He thought they would all agree with him that no men should be allowed, without proper

qualification and training, to carry out the important duties of meat inspection under the Public Health Acts.

DR. R. SYDNEY MARSDEN (Birkenhead) said that Dr. Hime had raised one of the most important subjects with which many of them would have to deal when they got into practical work. That question was how far a carcase could be diseased by tuberculosis, and yet be judiciously passed. He begged to differ from Dr. Hime when he said that the majority of medical officers of health take the view which Dr. Hime did, because it was his experience that Dr. Hime was frequently opposed to medical officers in their action for the condemnation of tuberculous carcases. Therefore it could not be true that they were all agreed on the subject. At the same time, what Dr. Hime said required very careful consideration from a practical point of view. Unfortunately, the medical officer of health had not the decision of the matter. They had to go to a magistrate (often without special knowledge) to issue a condemnation order, and magistrates frequently would not believe what they were told by scientific witnesses unless visible evidence were produced in support of the contention. And this cannot always be done, hence the difficulty. The question often arises, how far the disease may be localised, and no word is more abused than this in regard to cases of tuberculosis. He once heard an expert witness of considerable distinction say that although the disease was in 24 different glands of a body of beef, distributed from the neck to the pope's eye, the disease was *localised* in the glands; the inference being that it was a case of localised disease; the carcase was riddled with tuberculosis, and yet they could have this assertion about localised disease. He was not one of those who denied that localised tuberculosis could exist, it frequently did; but it depended upon the source of infection, the mode of entrance into the tissues, and how far the bacilli have travelled before they have been filtered out. One of the difficulties they now had to meet was whether they could have a fore-quarter of beef affected and the hind-quarter not affected. They would have to fight that out with the butchers and in a court of law. Dr. Armstrong said if there were five nodules on the pleural surface and in the glands of the thorax and chest, condemn the whole carcase. He was not so certain that Dr. Armstrong was not scientifically right. But if the hind-quarter were cut off from the fore-quarter, and thus made into two distinct pieces, how were they going to deal with them? Practically, they could not deal with them, and they could not get out of the difficulty because they had to go to a magistrate who would want ocular demonstration of the disease in both pieces. Now, there were one or two statements in the papers which he would rather like to reconstrue, because otherwise they might mislead. Col. Notter said that good healthy meat should be firm and elastic to the touch and should scarcely moisten the fingers. "Bad meat is usually wet, sodden, and flabby, with the fat looking like jelly or wet parchment." He took

exception to that description; bad meat might look like that, but it did not frequently look like that; it must be in a very bad state to reach that stage. Then Col. Notter said diseased meat has a cadaverous smell; but there is much diseased meat which has no cadaverous smell. Then Col. Notter laid stress and importance upon *filarius strongylus* or pseudo-tuberculosis, which is a very common disease among sheep. Dark spots were found on the lungs, which often gave rise to considerable trouble in the minds of the inexperienced inspector; they thought they had got a tubercle, and yet the appearances did not quite correspond. *Filarius strongylus* rarely does any harm; Mr. Hunting stated the conditions under which it does harm. There was one important section of meat inspection which had never been properly studied and was not fully carried out (he thought Mr. Hunting would agree with him) and that was in regard to the inspection of the pig. If there was one class of animals used for food subject to diseases of all kinds it was the pig. Very often it was difficult to tell what is the exact cause of complaint in their case. A pig might be seen to be feeding in an apparently perfectly healthy condition in the evening, and before the next morning it would die suddenly. Then they had to decide from the carcase what had happened. Pigs were subject to all sorts of conditions due to shock; there was one condition of the pig known as "shot," viz., small hæmorrhagic patches all over the pleura and in the tissues, especially of the tissues and the muscles down the back-bone, which have little hæmorrhagic patches through them. Those patches could be produced by shock, and also by blood diseases, such as purpura hæmorrhagica, and the difficulty sometimes was to distinguish between them. Those were the kinds of questions they had to determine. Why do pigs so frequently suffer from all kinds of diseases? It was because they were given all kinds of filth to eat, sour food and rotten swill, anything was good enough to throw into the pig tub. The pigs ate this food and it produced inflammation in their liver, irritation of the alimentary tract, irritation in the kidneys. If there was an irritation in a vital organ of that description, then there would be changes in the flesh, and therefore one ought to be very careful to see the organs in any case of pig disease. Another important question was raised by Dr. Armstrong in regard to tuberculosis in frozèn animals. At Birkenhead he (the speaker) perhaps dealt with the largest meat supply in England. His average during the last twelve years had been 220,000 per annum of American cattle. This came in as fresh meat and did not come under the catagory to which Dr. Armstrong referred, but still, he would like to remark that when Dr. Armstrong said that the carcases were wrapped up in cloths and that more severe inspection ought to be made of this frozen meat imported at the present time, Dr. Armstrong did not say how it was going to be done, and there was some difficulty in it being efficiently done. It ought to be delivered at a depôt and thoroughly examined. Dr. Collingridge would probably tell them how he got over that difficulty of covering cloths, which appeared to be a difficulty at the start. The carcases

were delivered in cloths and the quality of the cloth was a practical and a very good index as to the place whence the cattle came. River Plate carcases have woollen cloths, Australian have cotton ones. The woollen cloths stretched in all directions. Cotton cloths would not stretch like woollen ones. But if they were to deliver carcases about the country and stripped off the cloths at the port of entry, then delivery in good condition would be prejudiced and they would have the whole butchering trade against them. Dr. Hime raised the question as to whether they should condemn drowned beasts or beasts strangled or anything of that kind. He thought Dr. Hime had raised a difficult point there. They would bleed a carcase and make the blood into a black pudding and eat it; but would it do them any more harm if it were left in the carcase or in the meat? Will it or will it not? That was the question. He was not prepared to answer the question straight away, because he had not hitherto looked at it from that point of view. But when an animal had been drowned or strangled it had gone through a preliminary process of excitement and fever; that excitement or fever would have produced changes in the physical condition of the blood and flesh, and this he had always understood to be one of the reasons and a sufficient justification for condemning such carcases, irrespective of chemical changes in the blood itself if allowed to remain in the body. He could not agree with Mr. Hunting as to the method of examining large consignments of frozen carcases of meat, viz., that if one in twenty were examined that was to be held a reasonable examination. He did not think that was a sufficient examination. It was the one in ten or twenty that would always pass. It was easy enough to have the animals hung up in rows, and any expert could easily pass 3,000 carcases in 3 hours, because the healthy carcase would be perfectly obvious to the trained eye; it is the one that deviates in the slightest degree from the normal that at once attracts attention. They would be astonished to see how a trained inspector would pass along a long line of carcases and pick out the one that is diseased. One other word in reply to Mr. Hunting's statement as to inspectors. Mr. Hunting and himself had always differed on this point, whether a person who is to be a meat inspector should be a trained veterinary surgeon or not? Of course, they would all agree that a veterinary surgeon should know the work better than anyone else. For inspection under the Contagious Diseases of Animals Act he was the only proper person. But when they came to the dead animal and to a trade which has tricks of its own, his belief was that a well-trained ex-butcher was best, such a man with a good knowledge of diseases would make the best inspector, for this reason, that a veterinary surgeon was a man in a different position in life, he could not go and do the rough work which the ex-butcher would do; he would not go pressing among the carcases and offal and the pickling tubs, and fetch the things out, and when he has got them in his possession carry them away with him in his pocket or in a sack under his arm. The inspector must seize diseased meat when he got the chance, he could not leave it, and therefore an inspector of meat must be in a

position to cut and take what he sees. If there was any question about the pathological condition, then it seemed to him they did not want both a veterinary surgeon and a medical officer as well. They were both trained pathologists, either ought to know the business, and one was sufficient. If there were two men knowing their business and they did not agree, then under which master were they to serve? There would be constant struggles going on between the parties. Mr. Hunting said the medical officer must decide, but could Mr. Hunting guarantee that the future race of veterinary surgeons would accept that view and that position? He saw a rock ahead. If they were going to have one supreme head, his authority must be retained. He for one would never be prepared to give up his powers of deciding pathological questions to his veterinary inspector. He had the greatest respect for him in all that touched the Contagious Diseases of Animals Act; he did not profess to know anything about the subject of disease in live animals; but when it came to a question of pathological change, he must decide in his own province and no one else. He would have liked to speak on the subject of the different diseases caused by inflammation, but time would not permit, and it was impossible to cover the whole ground of meat inspection in one short discussion.

LIEUT.-COL. J. A. NUNN (Army Veterinary Department) observed that the papers had been thoroughly discussed, but there was one point in Mr. Hunting's paper on which he would like to say a word, and that was in regard to the training of meat inspectors, and the course of instruction given by The Sanitary Institute. He had been through this course and had obtained the certificate, even after he had been twenty years a qualified veterinary surgeon. The impression that was abroad that anyone could come up and get the certificate of The Sanitary Institute was absolutely erroneous. The examination was a very stiff one, and anybody who passed it was, in his opinion, perfectly qualified to carry out an inspector's duties. Several questions had been raised that morning as to the advisability of condemning carcases that were only partially diseased, or of animals that had been drowned or strangled. The present position seemed to give rise to a good deal of dissatisfaction in the meat trade. The difficulty had been got over in Germany by what is called the "Frei-bank" system; under which the carcase is condemned as not being first-class, but not as being dangerous to health or unfit for food; the meat is disinfected, sterilized, and then sold on the "Frei-bank" as second-class meat, and it is largely purchased by the poorer classes of the population. The subject of dirty butchers' knives had also been brought forward: in England it was a crying evil, in Germany it had been legislated for, and in the public abattoir of Munich the knives were all metal-handled, and have to be sterilized before they can be used on a second carcase. A point which to his mind required consideration at the present moment was, that there is now and will be in the future a large importation of foreign meat into this country; and in foreign countries there are diseases that

are unknown in these islands. Only the other day the report of the Agricultural Department of New Zealand was sent to him, which contained an account of a disease, called epizootic mammitis in cows, which, he believed, had never been seen in this country. Another point which had not been touched on was the putrefaction of salt meat when it was hurriedly prepared, as it was by the injection of preservatives; the animal was killed and the ham or bacon packed within twenty-four hours. The question of the deterioration of the flesh was one that should be considered. Mr. Hunting was a member of the same profession as himself, and naturally he agreed with him that the veterinary surgeon is the proper person to carry out the inspection of meat. In the French Army the veterinary surgeon was the inspector of meat and animal food, and the medical officer was the inspector and authority for other foods. In England they must allow that there was very little systematic arrangement of meat inspection; in fact, the inspection of it at all was a latter-day product. On the continent the inspection had been carried out for a much longer period and was much more thorough. In Paris and other large French towns, as well as in Berlin and St. Petersburg, private slaughter-houses were forbidden and Government abattoirs were established; the three he was acquainted with are most elaborate and efficient, checking effectually the palming off of diseased meat on the public. In England we had not arrived at this stage yet, and as long as private slaughter-houses are permitted he failed to see how proper safeguards could be carried out.

DR. COLLINGRIDGE (City of London) thought it must be admitted that the only proper solution of the problem of meat inspection was the provision of public abattoirs. He looked upon the question of whether the veterinary surgeon or the medical officer should be the judge of meat as a question that is absolutely settled. The veterinary inspector is, in his opinion, the only man who is capable of judging as to the condition of a live animal; when the animal had passed into the carcase form then the question was entirely one for the medical officer to deal with. The reason why animals not properly bled are condemned is because the blood decomposes very rapidly in the body of the animal, and therefore the whole carcase speedily commences to putrefy. That was the main reason, and probably the only one. With regard to the question of the tubercle, it was all very well to discuss it from the academic point of view, but the work had to be considered from a practical point of view. There was ample evidence to justify the requirements of the Local Government Board as set out in the circular to which reference had been made. It was on that circular they would have to act, and by that circular they would have to stand; there was sufficient evidence for that opinion. (This has since been confirmed by the Interim Report of the Royal Commission on Tuberculosis.) He thought it was sufficient for the practical carrying out of the work of meat inspection. Some question was also raised as to the localization of tuberculosis in the human being and the suggestion that

the human being could be cured by treatment. He desired to point out, however, that the evidence of cure in the human being was foreign to the subject; it was after all a matter of inference and assumption. They were not prepared at any time to say that tuberculosis had been absolutely cured; and, moreover, there was the very practical point, that while the human being is under treatment for tuberculosis in any shape or form, the conditions of life, the surroundings, the food, are all carefully provided for, conditions which obviously do not obtain in the case of the lower animals. The question of frozen meat had also been dealt with, and the possibility or impossibility of inspecting every single carcase had been insisted upon. The same question applied to the inspection of fresh meat on a large scale in markets. The proper place for the inspection of meat was at the slaughter-house, at the time of slaughter, when all the materials which were necessary for forming an opinion were present. It was very hard indeed to call upon a man to give an opinion as to whether an animal was fit for food when he had not the full material present to judge by, *i.e.*, he requires all the organs. They were only presenting him with half the case in asking him to pass an opinion on trimmed meat. Fortunately there was very little disease in frozen meat as we receive it, practically there is hardly any ever found; that fact, at any rate, gave the answer to one of the questions which had been raised. Then although the condition of the wrappers was no guide with regard to disease, with regard to the condition of the animal, *qua* putrefaction, it was of much assistance; they could be perfectly certain if the covers were clean they had not got the question of putrefaction to deal with, nor thawing. As to the stripping of the carcase, he quite agreed that it was not necessary to examine every animal; those animals were produced in batches, they were killed in batches, and they were shipped in batches, and they could be inspected in batches. Each of those batches represented the product of some particular place, with the same conditions obtaining in the case of all of them. It was therefore only necessary to keep a general supervision over these animals, and to inspect a certain number. It was quite possible, as had been said, that an unsound animal may be passed. There was no inspection possible or practicable on a large scale which would absolutely preclude the possibility of one single unsound animal being passed. That was a counsel of perfection to which they did not attempt to attain. To even attempt to attain to it would involve a great deal in a market he knew, where 4,000 tons of meat a day went through. It would require a considerable staff of inspectors, and whatever the number of officers provided, it would absolutely preclude the possibility of any trade being carried on at all. As regards the stripping, it was easy enough to strip them and to replace the cover in such a way that no harm results to the meat. What was the efficient way to deal with the inspection of foreign meat for disease? The remedy had already begun, because the evil was so apparent that, like all other evils, it brought its own remedy, and must do so in time. With regard to the case of pigs from Holland, which were at one time extensively diseased, the Dutch Government had taken

up the matter, and now had a system of inspection and registration of all animals that are slaughtered, and those were marked in such a way that it could be seen when they came in if they had been inspected or not. That was dealing satisfactorily with the question, and that was the way in which foreign meat must be dealt with, whether coming from the Colonies or elsewhere. There must be some guarantee that it has not only passed Government inspection, but that the inspection has been made with a certain definite object, the object of determining whether at the time of despatch it was fit for food. There were many difficulties and technical points with regard to the inspection of meat, but they should not forget that in dealing with the question of the sale of unsound meat they were dealing with a criminal offence. Therefore the Legislature very properly insists that every possible advantage shall be given to the owner or to the butcher. The whole object of meat inspection was to prevent injury to the public health; the object was not in any shape or way to unnecessarily harass or to persecute a trade. He desired to lay stress on that point because there was a need for it, and the need had been recognised by The Sanitary Institute in forming a course of study and education in order that men might be properly trained, that the mistakes which occur from time to time shall be reduced to a minimum, and that the operations of the authorities shall not be of such a nature as to harass the trade. It is in the co-operation of the trade in meat inspection that the public are protected, and without that co-operation it would be impossible to carry out the duties of meat inspection sufficiently and efficiently.

MR. JAMES KING (Veterinary Inspector, Metropolitan Cattle Market) endorsed the remarks of Dr. Collingridge, and stated that tuberculosis always cropped up at such meetings as this, when the question of meat inspection was being considered, and it was also discussed at the expense of other important diseases or conditions which rendered carcases and meat unfit for human food. No doubt it was the disease most easily recognised by medical officers of health and sanitary inspectors, but he did not think that, so far as beef was concerned, it was such a terribly dangerous disease. With their present knowledge it was about time they began to distinguish, not only, as Dr. Marsden said, between localised and generalised tuberculosis, but also between localised, extensive, and generalised. If there were lesions of the disease from the neck to the hind-quarters, the carcase certainly ought to be condemned. In practice they would often get the fore-quarter diseased, but on searching, either macro- or microscopically, they would fail to find evidence of the disease in any of the glands or tissues of the hind-quarters. That had been proved by the Royal Commission. Why, then, should they deprive a man of the whole carcase when they could protect the public by only condemning a part of it. They adopted the recommendations of the Royal Commission and acted strictly up to them when dealing with home stock, so why should they not apply the same conditions to foreign meat. They also prevented stripped meat coming into this country, but allowed

the Americans to cut up such meat into chunks and send it over in boxes labelled "Inspected Meat." He did not agree with those who objected to stripping. A butcher should be allowed to strip a carcase if he thought fit, as it was his property. The stripping of the carcase was necessary for various reasons, and in his (Mr. King's) opinion it should not be taken as evidence that the animal had been infected with tuberculosis, or of a guilty knowledge on the part of the owner. An inspector might presume that something was wrong, but he ought always to be able to satisfy himself as to the reason for stripping by the condition of the glands. His experience in examination of carcases and meat inspection extended over a period of fourteen years, and he knew that a large number of animals suffered from pleurisy, and that after recovery the pleural surfaces usually remained adherent. When the carcase is being dressed the lungs have to be torn out of the chest, leaving a roughened surface. In such cases the butcher, in order to make the carcase marketable, removes the rest of the pleura, or otherwise strips the whole chest. This, he knew, was objected to by many medical officers of health and sanitary inspectors, but with our present knowledge we can easily find the reason for stripping by examination of the lymphatic glands, the normal condition of which every inspector should be thoroughly acquainted with. If he (Mr. King) found the glands of the carcase apparently healthy, although he may have found the disease localised in some of the organs, it was his custom to pass the carcase and to condemn the whole of the offal. With regard to pigs it might interest them to know that recently, he and his assistant, at the request of the Cattle Markets Committee of the City of London, made careful post-mortem examinations of over 15,000 pigs, the object being to ascertain as near as possible the percentage of those affected with tuberculosis, and the loss sustained by the trade thereby. They found 75, or about one-half per cent., of the number subject to the disease, the value of which, it was ascertained, would amount to about £187. When inspecting carcases the majority of inspectors now acted in accordance with the recommendation of the Royal Commission on Tuberculosis, which allowed them to use their discretion with the carcases of cattle; but, unfortunately, they were not allowed to do so when dealing with the carcases of pigs—the recommendation being that, owing to the greater tendency to generalisation of the disease in pigs, when it is found in any part of the carcase, the whole should be seized. He could not help expressing the opinion that this, with our present knowledge, is a great hardship to the trade. In cattle there was the possibility, in some instances, of diagnosing the disease during life, and very little difficulty in recognising the lesions after slaughter, but in the case of pigs it was entirely different. It was well nigh impossible to diagnose tuberculosis in those animals, and also difficult in the majority of cases to recognise the disease in the carcase, which might appear to a butcher or inspector (who had not seen the internal organs) to be perfectly sound; yet when the glands were incised, the carcase might prove to be extensively diseased. The living membrane of the chest and abdomen were not often affected

as in cattle, and when they were the tubercles were not so numerous, and being much paler, were not so easily noticed. The most common seat of the disease was the glands of the throat. In the course of their investigation, a careful examination was made of all the exposed glands. The glands of the throat and neck were also carefully manipulated, and when found enlarged, the neck was cut into and the cause ascertained. In about 30 per cent. of the pigs condemned the disease was found in those glands only, and no other lesions discovered in other parts of the carcase. It was in such cases as these that the trade complained, and considered the condemnation an injustice, and although it was his duty to seize the carcases, he could not but agree with their views, considering that no compensation was allowed, and knowing the difficulty of recognising the disease during life. He certainly thought that, with the improved knowledge of inspectors, this recommendation regarding the condemnation of tuberculous pigs might now be modified so that they could use their discretion in dealing with pigs as with cattle. This, he understood, was done in Glasgow where, after careful examination, if the glands of the throat only were found affected, the head and affected parts were removed and the remainder of the carcase passed. When a consignment of pigs was found tuberculous it would often be noticed that the pigs came from certain districts and had been fed in the same way, and the disease would often be found in other consignments which came from the same area. He had found the disease in, and had had to condemn, a whole consignment of twelve, and in all cases the glands of the throat had been the primary seat of the disease. He could not help expressing the opinion that this was largely due to careless and ignorant feeding. In London and other large market centres where there was now a proper system of inspection of cattle and carcases, the risk of sending old worn-out tuberculous cows for slaughter was now increased, and there was no doubt that many were now being given to pigs as food. He had himself seen, within ten miles of London, the skeletons of three cows and one horse lying in a pig yard. It seemed to him a great injustice that feeders should be allowed to do this, and that the trade should bear the loss. Dr. Marsden mentioned that he frequently came across pigs with hæmorrhagic patches on the pleura and the peritoneum. This condition, unfortunately, was becoming rather common, and was recognised by veterinary surgeons as the lesions of purpura hæmorrhagica.

DR. MARSDEN: Do you condemn them?

MR. KING: Yes! and the trade have never objected to my doing so, as they consider them unmarketable. With regard to drowned or strangulated animals, he agreed with Drs. Collingridge and Marsden that in such cases a considerable time usually lapses before the viscera is removed, decomposition commences in the bowels and stomach, and rapidly extends to the surrounding tissues. This can easily be demonstrated, by cutting a small piece of the kidney fat of such a

carcase, and if the animal has been dead for any length of time, you will be careful about repeating the test. The fat smells horribly, and such carcases, in my opinion, have no right to be passed for human food.

Col. J. Lane Notter, in reply, said there were only one or two points that required notice. Dr. Hime had misread his paper, for he had distinctly laid down that "when tuberculosis is present and well defined and the glands are affected," these conditions should be considered when giving an opinion as to the disposal of carcases and condemning them as unfit for food. Dr. Hime's remarks were therefore based on a misapprehension. The discussion had revealed the fact that there was not a great difference of opinion between authorities dealing with food supplies. Most of the speakers had been answered by others who had contributed to the discussion. With regard to drowned animals, no doubt the rapid decomposition and putrefaction which takes place in these cases was the guiding factor in condemning the meat. He thanked the meeting for its considerate reception of his remarks.

Mr. W. Hunting also acknowledged the compliment. He said that he agreed with Col. Notter that the various speakers had pretty well answered each other. He had little to add to what had been said, but he would like to take the opportunity of pointing out to Dr. Marsden that Dr. Collingridge supplied a practical argument in favour of veterinary inspectors, although he had never specifically mentioned them. Dr. Collingridge had said that it was a remarkable fact that almost the whole of the frozen meat imported into this country showed no disease. Abroad there were quite as many diseases of animals as we have in this country, but all that meat was inspected by veterinary surgeons before it was sent to this country. Dr. Armstrong had referred to offal being sent in boxes; now they were not all *au fait* with the work of foreign meat inspection, but he imagined that those boxes contained many pathological specimens. Dr. Marsden would know that. Dr. Hime thought that the fatty liver of animals might be treated as *pâté de foie gras.*

Dr. Hime: The animal parasites.

Mr. Hunting pointed out that the liver of the goose was purposely fatted; no doubt it was harmless enough. But fatty liver in animals might be accompanied by disease and might be poisonous. He did not fancy "pâté de tapeworm." Everyone of those parasites contains a toxine; experiments recently made showed that the juice of the occupiers of the intestinal canal of animals injected into animals had fatal results. So that these parasites could not be described as altogether harmless.

The Chairman, in summing up the debate, said he was not in a position to enter into a scientific discussion of the subject. He had been engaged in the

meat trade for thirty-five or forty years, and naturally took a great interest in the questions raised. It had properly been suggested that the same law should be applied in one town as in another. He remembered the time at the Central Market when sheep diseased with fluke were condemned, yet on the other side of the road (almost a part of the market) such sheep were allowed to be sold. He agreed with Inspector King that while a fore-quarter might be affected with tuberculosis the hind quarter could be free, and it was reasonable to pass the sound portion. It had not been mentioned that day, but the trade was most anxious that inspection should take place. In the markets the inspectors were often called in by the traders who were not quite sure that they ought to sell. The inspectors would admit that they were continually asked to deal with meat that might not be quite fit to go out to the public. He could assure them the care taken now was extreme. There were buyers who would not have any meat leave the market until the inspector said it could be properly removed. He thought it should go out to the public that they were protected in this manner by inspection, and he hoped that soon there would be a general agreement on practical points so that the men in the trade and the inspectors would know exactly what their duty is under every circumstance.

CONGRESS AT GLASGOW.

INAUGURAL ADDRESS

By The Right Hon. LORD BLYTHSWOOD, LL.D.,

Lord-Lieutenant of Renfrewshire.

PRESIDENT OF THE CONGRESS.

Delivered July 25th, 1904.

WHEN I was asked whether I would occupy this most exalted position, to which you, gentlemen, have so kindly elected me, I said that I felt I was not equipped to take up the position or to speak in the chair at a Congress such as this, a chair which had been filled by so many eminent men, the names of whom you have heard read just now. Since I have heard those names I can assure you I feel that my words were words of prophecy, and I crave the indulgence of the audience now before me in the work I have to do.

I trust you will forgive me if the address that I give you is a short one. I hope to touch upon some things which may be new, but in view of having experts close around me, experts who are going to speak at their various sections, experts who have spent their lives in this most interesting, and I may say most tremendous, question, this question of public health, you will believe me that I, who am only a tyro in these matters, feel that my training has been quite different. The training that I have given myself in scientific work, whatever that may be, has not led me to consider this great question of hygiene as deeply as no doubt I ought to have done. Still, at the same time, I am a volunteer, and therefore in what I may say this evening I trust you will forgive me if it does not come up to that standard which the eminent men who have gone before me have so worthily upheld.

I must also thank two gentlemen, Mr. Samuel and Mr. Fyfe, for the great assistance which they have given me.

I believe that it is now twenty-one years ago since the Institute last

visited Glasgow; I believe that was in the year 1883, and I feel sure that if there are any members here this evening who came to this city twenty-one years ago, they will see the fruits of their labours in the increased sanitary comforts and arrangements of the city. In Scotland, though no doubt for many years much had been done to improve the sanitary condition of the people, both in the towns and in the country, I may say that sanitation as now recognised came into life in 1885 with the Scotch Registration Act, since which date we have accurate records. But I should just like to touch on the really dreadful condition of things under which the poor people, not only in the towns but in the villages and country districts, lived. A most interesting book by Dr. James Russell was given to me, and I will quote to you just a few lines. For many years Dr. James Russell was Medical Officer of Health in Glasgow, and his report which has come to me is so pertinent and so capable of being understood to-day that I will quote it, although it is most astonishing, and I should have thought that it was almost impossible, that such could have been the condition of Glasgow at the time of which he speaks. But the books and accounts of the country that I have read make it quite evident that there was no exaggeration in what he wrote. He says: "If any man wonders at the prevalence of continued fever among the lower classes in Glasgow"—he is writing of 1818—"let him pick his steps among every species of disgusting filth, through a long alley from four to five feet wide, flanked by houses five floors high, and here and there an open pool of water from which there is no drain, and in which all the nuisance of the neighbourhood are deposited in endless succession, to putrefy and waste away in noxious gases; let him look as he goes along into the cellars which open into these places, and he will probably find internal habitations which no one can distinguish in their exterior, or from the very little bare furniture that is within them, with pigs, cows, and human beings that can scarce be recognised till brought to the light."

I could go on further, but I think that that is a sufficient picture for us to recognise the condition in which Glasgow was in the year 1818. I must point out that it was most difficult to ascertain and to classify the death-rate of the population in the early part of the century. From 1821 to 1832 the city was devastated with epidemic fever and small-pox, and with typhus; from 1832 to 1853 there were three attacks of cholera; in 1843 more than a quarter of the inhabitants suffered from a relapsing fever. It is somewhat difficult to convey to the present generation what all this meant to our forefathers, but an attempt may be made so far as figures will go. In 1837 the population of Glasgow was 253,000 in round numbers,

and the death-rate was 31 per 1,000; in 1847 the population was 320,470 and the death-rate had risen then to 56 per 1,000. In 1893, when the population was 677,880, the death-rate was a little more than 23 per 1,000, shewing a great decrease. In 1903, the last returns that have been available to me, the death-rate has decreased to 18·4 per 1,000, and the year 1903 is chosen as the worst epidemic year of modern times. In this year the total number of deaths from infectious diseases of every description registered was 17,100, so that if every one had been caused by typhus, notwithstanding the increase in the population, we should not have had so much infectious disease or so many cases as there were in epidemic years in the first half of last century.

Well, I think you know, ladies and gentlemen, that that is a wonderful proof of what has been done in Glasgow for the sanitary education and for the sanitary business and work of this great city. I do not wish, as I said before, to go more deeply into these figures, because I know that there are others who will come after me who have made it their life's study, and who have gained fame in doing so, who are far better qualified than I am to deal with these great questions, and with the great work which has been done in the city of Glasgow, but I wish at the present moment just to bring before you a kind of sketch of what has been done. I think I have been able to point out at any rate a condition of affairs in the city that was terrible, at a time when everything that was filthy was pitched into the street, where it was allowed to fester till it was taken casually away to the surrounding fields. Indeed, in the earlier part of the last century that was no peculiarity of Glasgow. I was reading only the other day that in a certain royal burgh in Ayrshire, at the beginning of last century, a noble lord of high degree who lived near could not ride down the High Street until the middens had been taken away. Well, that was the way in which, I suppose, people lived in those days, and it is only wonderful that more deaths from disease did not take place.

It would be useless for me to go more thoroughly into those times. As I said, the Registration Act came in in 1855, and from that time we have been able to classify not only these deaths but also all the other deaths in the country, and to have before us a truthful record and description of what is occurring in the country, and of the incidence of disease.

In 1859 pure water was supplied from Loch Katrine, it having formerly been supplied by two companies, one in the Gorbals—and where do you think the other company's water came from? Why, the Clyde. Well, when water was brought in that manner can we wonder that the statistics of death in Glasgow were so bad? Is it not wonderful that they

were not worse? But there was one thing which the present generation has seen—the Clyde as it stands at the present moment. In those days there was no drainage into it, and immediately after the introduction of pure water in great quantities from Loch Katrine another problem arose, which I will deal with later.

In 1864 the first municipal disinfecting and washing-house was built, and the first sanitary office was opened, and you must remember this, that the first sanitary staff in the city of Glasgow at that time, as I am advised, comprised one man and a clerk, and it was situated in an obscure street. But in 1866 the City Improvement Act was passed, by the process of which the wynds and closes in the city of which I have already spoken were attacked. It was useless to provide wash-houses and to give the poor pure water, unless these parts of the city, with their overcrowding and utter disregard of all sanitary regulations, were cleaned out. The centre of disease would still remain. But all this work took a long time to accomplish, and it is indeed by no means finished or completed yet. This is a problem that will always be with us. What we have done is no doubt very remarkable, for we have, as I have shown, reduced the death-rate by certainly more than one-half.

You must remember that it was only a few years ago the foul disease of cholera put up its head in this city, and it was met by the sanitary officers and by the sanitary regulations, and practically scotched before it could ever get to a head. This is one of the great results which accrue from the scientific attack of disease, and also from sanitary regulations, and the opening out of those places which foster it.

But another problem presented itself as soon as pure water was introduced; a new means of getting rid of the filth had to be devised, drains had to be made, and where do you think they all went? They went into the river Clyde, which thus became an open sewer.

In 1881 the first refuse destructor was erected, but while all these things had been going on do not suppose that the community had not been thinking deeply. The central hospital of Glasgow was then, as it is now, the Royal Infirmary, founded in 1792, with which infirmary the name of Lord Lister will ever be connected. We have the Victoria Infirmary, founded in 1890; the Glasgow Eye Infirmary, founded in 1824; the Royal Hospital for Sick Children in 1882; the Glasgow Samaritan Hospital for Women in 1885, with many minor hospitals, attached to which are many convalescent homes. Then while I am talking of hospitals, I may mention one more thing. I do not think any medical man who is here this evening will deny that one of the greatest adjuncts

they have in combating disease and physical misfortunes (a good many of them) are those devoted women who attend as nurses in the hospitals of Glasgow. There occurs to me the name of Mrs. Higgingbotham, a devoted lady, who in 1875 instituted the district nurses to go among the poor with advice and consolation; and since that time we have had the Queen Victoria nurses, to whom the district nurses were affiliated in 1891. There were sixteen nurses then, and now we have twenty-seven. These women go among the poor, do their beneficent work, and bring sunshine and light into the people's homes, teaching the people how to second the efforts of the sanitary officers, doing the work as only a woman can in times of distress.

I have given you a very short and a most perfunctory description of the condition of Glasgow, and of the ways in which it has been lifted by wise men and by careful administrators into the position which the city now holds, with its vast population, which is continually increasing, of the work that it has to do, and the drainage works that are being carried on. I trust that when these drainage works are completed we shall be able to call upon the neighbouring towns and the populous places around to purify and clean themselves and their waters, so that we may look forward to a period when the salmon will again be seen in the Clyde, as well as in the city arms.

Now, there is one thing I specially wish to draw attention to, and that is the condition of the surrounding parts of Glasgow. It is absolutely necessary that we should consider this other great question, the blotting out of the light which should come to our city. In our northern climes we do not have so much of the cheerful visage of the sun as we might desire to have. All that man has done, at all events up to the present time, is to do as much as he possibly can to blot out the sunshine. Now, I do not think there is anything more vivifying, nor is there a more valuable sanitary officer than the sun himself. I was reading some of the reports that have lately been made on the great smoke nuisance, and of the experiments that have been carried out in Glasgow, and these will give you some idea of what we throw into the atmosphere. The facts will speak for themselves when I tell you that per annum 33·66 cwt. of black mineral stuff and grease is dropped on an acre of ground. But in addition to that, which alone is a very large and astonishing fact, which you have to take into consideration, I think you will agree with me that probably the greatest evil that accrues is, as I have said before, the blotting out of the light.

If I may be permitted for a moment to detain you, I should like to

draw your attention to the new conditions under which we shall have to combat disease. You have laid the foundations, I may say roughly, by bricks and mortar, by the introduction of pure water, by clearing out the dens that were centres of festering disease. Now what you have to do, as we shall certainly always have disease of some kind about us, is to endeavour to alleviate it to the best of our ability. Remember, one great problem which this country has to face arises, for good or for evil, from the policy that has been pursued in the past. Everyone knows that the people are leaving the country districts and are congregating in the great towns. You see in the papers continually the asking of such questions as, "Are we degenerating?" Well, we certainly shall degenerate unless we can carry out perfectly all these sanitary arrangements, and give the people who assemble in large communities that power of recuperation which the natural elements of health demand.

I know that the question of smoke is a very difficult question, but I should just like to bring before you for one moment my experience of it. Living as I do within seven miles of the city of Glasgow, I have been able at any rate to see how it acts upon the vegetable kingdom. When I was a boy, or a young man, on the walls around my garden were any amount of apricots and greengages. The trees are still there, but for many years there has not been such a thing seen on them as fruit. There has been no change so far as the care that has been given to these trees is concerned; but it is the fact, unfortunately, at all events down in the valley of the Clyde, probably from the geographical condition of things, the Highlands of Lanarkshire being colder than the lower lands lying around the sea, unless we have a strong wind from the south, the south-west, or the north-west, the air slides down from the colder parts of Lanarkshire through the valley of the Clyde, bringing all that smoke and smother which has been generated not only in Glasgow but all around it, thus cutting out the vivifying rays of the great master of this world. The consequence is that you find, as far as the finer grades of fruit are concerned, that they are absolutely extinct, despite the greatest care. The fruit houses in which you house them are also not exempt, because, however much heat you choose to give, you cannot give that tonic action which comes from the ultra-violet rays of the sun, which are necessary to vivify the organic system.

I bring this before your notice simply to put before you the great and important effects that must accrue from the present unfortunate condition of affairs. At the present moment I know how difficult the position is; I know how serious will be the imposition of any extra

expense on the great mercantile community with which I am proud to be connected; I know how difficult it is now for them to make, if I may say so, both ends meet. But at the same time I believe that if it were not for a certain amount of what may be called awful conservatism, I think it would be possible to take up some of the inventions which have been made. Some of them, of course, are thoroughly empirical, but there are some which not only reduce the cost by enabling the whole of the carbon to be burnt in the furnace, but also to purify the smoke that comes out, and will not be too expensive for practically dealing with it. At all events, it is a great problem for the people, and I do most earnestly trust that it may be brought before this Congress. I trust that in the future we may really feel that we are doing a great work if we can possibly get rid of that pall which hangs round our cities, and that these people who are coming in from the country to the towns may feel the vivifying influence, as I have said, of the sun, and be enabled by that means to recuperate themselves, and be able to do far more work in their own particular station in life in the great towns than they are able to do while they are going about in a miserable semi-darkness, as we often do in the winter time.

As I said before, the great work that has been done in Glasgow by the efforts and policy of the various authorities under the several Lord Provosts, has been so far successful, and I am sure that those members of The Sanitary Institute Congress who were here twenty-one years ago will agree with me that there is a great change for the better in this important city. When we can see the enormous amount of population, that is continually increasing, I feel almost proud to have worked with those devoted men who have done so much in carrying out the dictates which both patriotism and the desire to help their neighbours have implanted in them.

Now, I will lay this as a kind of foundation—I wish to touch upon one other question which I think is of great importance. I have spoken of Lord Lister and of the wonderful work which he inaugurated at the infirmary in Glasgow. He recognised there the infinitesimal, as it was supposed to be in those days. He recognised the enemies that there were continually about us, and by eliminating them as far as possible he gave to the surgeons a great aid; the last finishing touch that was required after the introduction of anæsthetics, by his epoch-making work which enables the surgeons of to-day to do those very marvellous and extraordinary operations which are now familiar to you on all sides. In speaking of this matter I wish to go a step further. I want you to know and to think of

the position in which all these great inventions have placed us, and of the advantages which have continually been given us. There is no wonder whatever that the sanitary art is one of such slow growth.

You have to combat crass ignorance. I may give you one instance of it. When I was going out to the Crimea with my regiment, the principal medical officer of the Army at that time was asked to send out chloroform for the purpose of reducing the suffering of those who might require surgical aid, and his answer was, "I certainly shall not send it; I look upon the stimulus of the knife as being far better." Now that was said by a humane man; that was the result of crass ignorance, even in a scientific man, who had worked hard in his profession. It illustrates the terrible amount of inertia which every one has to deal with who is at work under new conditions and for a new science, which sanitation really was in those days. What I wish to speak on now are the foundations which I have already laid down, which I think everybody now recognises, which I trust may be taught in the schools and to all young people. I want them all to know and learn and recognise the necessity of sanitation, because a very great deal that is harmful comes as the result of ignorance. People at one time did not believe you when you said a man had a cold and that they might catch it from him. They did not believe that a catarrh was an infectious disease; in the past they did not recognise that certain complaints were infectious, and so they ran about and disseminated illness all over the place.

I do not want to frighten people, but there are certain rules and regulations known to all medical officers of health now which greatly modify the spread of disease, especially among young children, and therefore I think if you possibly can you should get this elementary knowledge brought into all schools and encouraged by the school boards. Sympathetic answers have been given by the Government to representations on the subject. This great question of sanitation should be made a popular subject of instruction among the children, so that later on the knowledge would not strike them all of a sudden with strangeness as a totally new idea. I believe in this way you will help immensely those who are struggling to work for the great end that we are all pressing towards to-day, and so do all we can to eradicate the evils of the Past. Death we must have amongst us; death must always come to man; everyone of us must answer his last call at a certain time. But there is no doubt that we may be able, and that in fact we have been able, by scientific treatment, to reduce the death-rate and to increase the length of life of the population.

There is one thing, of course, which is very melancholy to reflect upon in connection with the great question of degeneration. We certainly have saved a large number of people who I might say had almost better have gone in infancy. These lives have to a certain extent been saved. In the old days only the fittest survived. Science now says very often that the infirm shall live and that the unfit shall be preserved, perhaps to be only a burden to themselves and their friends. No doubt this is our duty, but I do urge this one consideration when people take statistics up and speak of the degeneration of the country, they must remember this fact; that you are saving an immense number of human beings who otherwise would have been destroyed, and these people, I need not say, multiply among themselves and are not likely to bring forth very healthy inhabitants to this country. Therefore we must take all these facts into consideration in judging of large questions of race and population. At the same time I do most sincerely recognise the nature of modern conditions, and believe that it is our duty—our great duty, in fact—to do all we possibly can to make our towns and our populous places as sanitary and as healthy as possible.

Well, I was speaking of the infinitesimal as what we have now got to think of, and I was speaking of the necessity of the sunlight. Just consider what sunlight is. To-day you have that sunlight intercepted; it comes to you through a pall of smoke and fog, and yet that sunlight brings with it a marvellous power that is commonly very little recognised. Sunlight conveys with it a power which is one of the greatest germicides; sunlight conveys with it a power which is transmitted by the infinitesimal. We now must make use of this infinitesimal. It is a great power that has come to stay, and we have at last recognised its value.

It is curious how these things are discovered. I hope to be able in a few moments, without troubling you too long, to prove and explain it to you. Conceive what sunlight, what light is. The wave lengths of light forming deep red are the thirty-two thousandths of an inch long, forty-two thousandths for yellow rays (that is the sodium rays) and about sixty thousandths for the ultra-violet rays. Taking an average of these (the vibrations that enter your eye, which give you those magnificent prospects of which we are so proud, which I hope the members of this Congress will be able to see in the neighbourhood of Glasgow) the marvellous gradations of colour and light, the flashing water, the mists, and the hills around you—these are all conveyed to you by vibrations entering the eye at the rate of one hundred thousand million millions per second. Here indeed you are face to face with the infinitesimal. But what marvellous effects they work. The eye can see a great deal, and I have tried to describe what are

the beauties that it shows us, and how it elevates us and raises us from this earth to see the beauties of nature.

But, my Lord Provost, you who are an expert in photography could get up here and say how these marvellous infinitesimals shake the alloyed salts to pieces and produce on your plates the beautiful pictures of which you have given me one. But it is not only in photography that we find these wonders. We find them in the hospitals, where we try to imitate the sun by the power of the electric arc. You know how the light has conduced to reducing Lupus. It has been tried, perhaps in vain (I do not know, perhaps the time has not yet come), with that fell disease, Cancer. But still, here you have the infinitesimal in nature coming to your aid. It is light, the best light we can give, utterly small in comparison with that light which comes from the ruler of our system, yet it has done great good in these hospitals. We have it in the Royal Infirmary, I think, but at all events it is used in Glasgow.

And then there is another great agent we have, also the infinitesimal, that is electricity itself. Electricity under skilful hands, like those of Dr. Macintyre, has done great good in the Royal Infirmary. Many is the time I have spoken to him upon these subjects, and I am thankful to think that he is hopeful, more than hopeful, of being able to relieve human nature of some of its greatest ills through the agency of electricity. One great reason, I think, why electricity is not more used is that it requires a highly scientific training to be able to use it with the best results. There are so many charlatans going about with their electric belts and all that sort of thing, which have nothing at all to do with electricity, and there is no connection whatever between the two things. But properly used and properly applied I believe that there is to be found in the electric infinitesimal one of the most wonderful things on the face of this earth. We do not know exactly what it is. Even Lord Kelvin, whom I have often described as the High Priest of electricity, a man who knows almost everything, when I asked him the question "What is it?" said "We may know, we do not know yet." But we do know this: that we can use it, and the business that we have to do is to use those things that God gives us, and to use them for the good of our people as well as we can. We may make mistakes; but those are things we cannot help. It is the frailty of our nature and the limitation of our knowledge that lead us to make mistakes. But I think everyone will agree with me that we have had our talents given to us, and it is our business therefore to do our work as well as we possibly can. It may be that our talents are not equal to the work that is given us to do, but at any rate let us try, let us

work, let us not consider because a thing is not understood, because it cannot be calculated accurately, that therefore it is beneath our notice.

Now it is these wonders that are continually coming up before us that make us believe that it is absolutely necessary that we should cast away some of our old ideas. I think you will agree with me that that has been true of surgery, as it is at the present moment true of medicine. But why? Even eminent medical men to whom I have spoken on the subject have told me that we do not know actually why the smallest things do what they do. I can swallow something that does not go down to my lungs and yet it does them good. How does it work? Here again I believe that we are face to face with one of those wonderful wonders of Nature, the nerves and the nervous system, and the nerve centres.

Have you ever considered how much a man has to do with disease; how a man can fight hard with nature, and how often it has been said "Oh, he will recover, he does not intend to die, he is going to fight for it;" yet another man, equally strong, with the same chances, slips away and gives up the fight? That is merely the infinitesimal over again.

Well, let me just ask you one more question. You know these great problems, and I think we ought to go forward and probe them as much as we can, and endeavour to recognise them in all their bearings. There is another thing which has startled us during the last few years—that wonderful thing called radium, a subject in which I have taken a great deal of interest. There again we are face to face with the infinitesimal, yet radium is a great force. I know it has been used in the hospitals. I do not know for myself whether it has done all the work that it was intended to do, but, dissolved as Nature does it, I think that it has wonderful curative effects. There are many things upon which doctors agree, but all who have spoken to me on the subject have told me one curious thing, that salts in ordinary water, whatever salts you may put in, never penetrate through the skin. Naturally, the question I immediately ask them is, "Then, what is the good of my going to Bath to bathe in the waters there? They certainly do me good." Their answer is that they do not know. Now there is no doubt that in the Bath waters radium exists—I have seen it myself. If we have these wonderful emanations coming through the waters there, you may have the answer to what was inexplicable before. In Buxton you have the same thing, although not so strongly as at Bath. Here then again we are face to face with the wonderful infinitesimal, and we must make use of these things. We are forced now to believe in things that we can only at best calculate, we cannot yet understand them, and we may never see them to perfection; but we can

if we use them rightly, I am sure, alleviate many of the pangs of human nature.

There is one other great thing that the work of your Institute is doing now, a work to which I am sure you are all willing to put your hand to the best of your ability. By increasing the sanitary comforts of this country, by improving the sanitary conditions of the towns to which the people are flocking, by improving the condition of the people's lives, you are giving a tone to our population, and are so doing a great and material work. We are all proud of the work which our forefathers did, and we intend to hold it. But we shall not be able to do so unless we can make and keep the population of these islands at the same high standard they had before, which I trust they may ever have, and certainly one of the great agents for doing that and maintaining that high standard will be Sanitation.

CONGRESS AT GLASGOW.

SECTION I.

SANITARY SCIENCE AND PREVENTIVE MEDICINE.

ADDRESS

By Prof. J. GLAISTER, M.D., D.P.H., F.F.P.S.G., F.C.S., F.R.S.E.

PRESIDENT OF THE SECTION.
(FELLOW.)

SMALLPOX INFECTION FROM HOSPITALS:

A Critical Study of the Doctrine of Aerial Convection of Smallpox, based upon the Histories of Previous Epidemics.

OF the many problems in Preventive Medicine which are occupying the attention of sanitarians at the present time, probably none is of so great and urgent importance as the prevention of smallpox.

Although for over a century a preventive remedy has been discovered whereby its fell ravages might be stayed, and although the practice of vaccination has been the statute law of this country for about half that period, the sanitarian is being confronted in different parts of this country at the present day by more or less widespread epidemics of the disease, which cause great discomfort at least to those who are stricken, some loss of life in those who are unvaccinated, much anxiety to the communities in which the outbreaks occur, and considerable outlays of public money in effecting their repression.

A necessary part of the machinery to deal with such outbreaks is the smallpox hospital with all the administrative machinery which it involves, necessary because vaccination practised in infancy does not afford a life-long immunity against the disease, although calculated to permit only of modified forms of attack when infantile vaccination has been efficiently performed, but chiefly, because there exist in our populations those upon whom the operation of vaccination has never been performed, and who,

consequently, after exposure to infection are seized with the graver forms of the disease, and thus become a menace generally to the public health.

The net result of the operations of the present vaccination law in this country up till the present time is that the great bulk of the community has been protected against the more generally fatal consequences characteristic of those outbreaks which occurred before vaccination became a compulsory measure. Smallpox has now lost many of its terrors for communities because of this, and because of the knowledge, based upon the experiences of every country in which vaccination has prevailed, that an attack after primary vaccination is but rarely attended by symptoms which menace life.

On account, however, of the relatively temporary immunity which primary vaccination affords, the need for re-vaccination between the tenth and twelfth year of life has forced itself upon the minds of those engaged in the public health service. But re-vaccination is not compulsory at present in this country; and on account of the less prevalent practice of it, even in the face of epidemics, there is now in our midst a large population whose original immunity against the disease has become so lessened by the lapse of time, that epidemics of the milder forms of the disease may be expected to happen from time to time in our larger populations, as recent experience has shown in different cities of this country. Indeed, the history of the last twenty years, and more particularly of the last ten years, abundantly proves the truth of this. Moreover, this state of things has led, and will in the future lead, to a somewhat unexpected difficulty in the repression of outbreaks, viz., the difficulty, nay, inability, in not a few instances, in discovering the sources of infection due to ambulant cases of the disease which are so mild that they give rise merely to a few days' indisposition, and very often to the neglect of calling for medical attendance. Such has been amply demonstrated in the epidemic of the disease in Glasgow, and in other places.

So long, therefore, as this condition of matters continues, the smallpox hospital must remain an essential part of our armamentarium against the spread of the disease.

Did re-vaccination, however, become the common practice in this country as, for example, it is in Germany, the hospital devoted to the sole uses of smallpox treatment might be allowed to fall into desuetude, and cases of that disease, when they did arise from importation, as they are bound to arise owing to the dissimilarity in efficiency of the practice of vaccination in different countries from which emigrants come, and because of the movements of persons from nation to nation through commercial inter-

course, could be treated in our general infectious hospitals, or, indeed, in our general hospitals, because of the then protected position of our people.

This is exemplified in the smallpox history of Germany, as shown in Dr. Bruce Low's Report to the Local Government Board of England "On the arrangements made in Germany for the isolation of smallpox cases."

When Dr. Low began his investigations in Germany, he first proceeded to Berlin. He himself after inquiry could hear of no smallpox in that country. The Central Health Office in Berlin knew of none. Accordingly, it was arranged that he should visit chief representative cities of the four principal States of the German Empire. He visited ten cities in all these different States, the total population of which was nearly five millions of persons. He could not find a single case of smallpox in any of them. During the years 1895–1901 inclusive, there had been only 70 cases in Berlin; in Cologne, 1 case during ten years; in Wiesbaden, there were 12 cases eleven years ago, but there had been none since that time; in Mainz, there had been no case during eleven years; in Munich, there had been 7 cases in eight years; in Nuremberg, none for about eleven years; in Dresden, there had been no deaths from the disease during the previous ten years; in Leipzig, there had been 8 cases in eight years; and in Stuttgart, there had been no case during six years. He was informed that the cases which had been present in Germany during these years had been imported from neighbouring States, as Russia, Austria, Italy, or other country.

He contrasts the position of Germany with that of our own country in respect of the incidence and mortality of smallpox. During the twelve years, 1891–1902, Germany with a population of 56 millions had only 607 deaths, while Great Britain with a population of 32 millions had had, in the same years, 6,761 deaths.

With regard to hospital provision for the isolation and treatment of smallpox, he found the practice of these countries to differ materially. Compared with the provision in this country, that of Germany may be said to be non-existent. In Berlin, for example, with a population of two millions, the entire provision for smallpox treatment is twelve beds made up of a pavilion containing two wards, not in a special hospital, but forming part of the Royal Charitie Hospital of that city, which is one of its largest general hospitals, consisting of 1,500 beds. The smallpox pavilion is separated from the nearest scarlet fever ward by about 24 feet, and is distant only 150 feet from a street which bounds the hospital, and from an open fence which separates the street from the hospital grounds. The cooking for the smallpox patients, when there are any, is

done in the general hospital kitchen, and the soiled linen is washed in the general laundry. It is compulsory, however, that the staff in attendance upon the smallpox patients must be re-vaccinated. Isolation, therefore, as we understand and practise it in this country, and as exemplified in the regulations for erection of hospitals of the English Local Government Board, does not prevail in Germany. The only hospital in Germany which Dr. Low found was devoted to smallpox was in Mainz. It is situated in the grounds of a florist and nursery gardener, in which also are the gardener's house, greenhouses, etc. It had been erected in 1892 for cholera, but since that time had been left for smallpox. So far as Dr. Low could find out, there never had been a case of smallpox within it.

The reason why there seems in Germany to be such a contempt of smallpox is to be found in the protected condition of the entire population of the country by vaccination and re-vaccination, both of which are by law compulsory; and it is for the same reason that when cases of smallpox do arise in populous centres, they are treated in the wards of a general hospital, and their existence utilised for the purpose of the clinical instruction of medical students.

It is only necessary to compare and contrast the enormous capital expenditure in smallpox hospital erection and the annual cost of upkeep in this country, with the absence of both in Germany, to demonstrate the great advantages which would be conferred upon this country by a compulsory system of re-vaccination, leaving out of the reckoning the enormous private loss which is involved in the sickness of patients from the disease. So long, however, as a general compulsory system of re-vaccination does not exist in this country as a legislative enactment, so long will it be necessary for the State and local authorities to maintain efficient hospital equipments to cope with recurring outbreaks of the disease; of the milder forms in the vaccinated, and of the graver forms in the unvaccinated and in the inefficiently vaccinated.

This brings me to the question with which I propose more particularly to deal in this address, viz.: The Influence, if any, of Hospitals devoted to the Treatment of Smallpox upon the communities in which they are placed.

Involved in this large question are several propositions which must be subjected to careful and critical scrutiny before definite opinions may be expressed regarding them. It appears to me that the general proposition respecting smallpox hospital influence must be faced under two main heads:

I. The effect, if any, of a smallpox hospital upon neighbouring popu-

lations by reason of mere situation and propinquity, as exhibited in ordinary sources of infection, direct or mediate; and

II. The effect, if any, of a hospital owing to situation and propinquity, as exhibited in the production of infection of neighbouring population by other than ordinary sources of infection.

Let me first ask your attention briefly to the former of these propositions.

In considering the effect of a smallpox hospital upon contiguous population, prominence must be given to the fact that the hospital is a place which contains persons suffering from acute attacks of the disease, as well, usually, as convalescents. It differs only from a place containing a single case of smallpox relative to infective capability, in that numbers of cases are collected together, the combined effect of which is likely to increase the capability to infect. Consequently persons attached to the administration of a hospital must be subject to such rules as prevail for smallpox contacts with regard to their potentialities for spreading infection. Such rules have been formulated, and are generally practised in such hospitals for those of their staffs who have occasion to leave hospital and mix with outside persons, among whom are likely to be susceptible people.

But dealing with the allegation that smallpox hospitals are the cause of spread of the disease to propinquous population, any inquiry as to the truth of the allegation must be founded on lines such as are likely to reveal whether or not mal-administration, or other conditions, have existed; in other words, whether facilities from the hospital have been afforded for the spread of the disease by the ordinary direct or mediate methods. Under the second proposition, prominence must be given in the inquiry to any influence which smallpox contagium may possess, because of some difference or differences which belong to it, as compared with the contagia of other infective diseases; that is, to properties peculiar to the contagium of smallpox, and to any special properties it may possess under any given set of circumstances relative to its convection in other than the usual methods.

It seems to me that in any inquiry regarding the influence which a smallpox hospital is believed to have upon contiguous population, it is absolutely necessary to discriminate between these propositions with which I have started, else we shall be liable to arrive at false conclusions.

In an inquiry, therefore, regarding spread of smallpox from a hospital, the line of inquiry must first be regarding facilities from the hospital for the spread of the disease outside by the usual channels, and by direct and

mediate methods, and the inquiry must be exhaustive in this direction before the question of possible spread by unusual means should be allowed to emerge. In the whole inquiry, too, if we are to proceed on safe lines, and hope to arrive at a true conclusion, the laws of evidence must be strictly applied. It may, indeed, happen that one observer of an epidemic and its relations to a hospital may fail to discriminate between the value of evidence pointing on the one hand to direct and mediate infection from the hospital, and of the evidence which is believed by him to be exhibited in a special mode of convection of the infection.

Infection in smallpox is either direct or mediate, or both. All are agreed upon this fact. And that such modes of infection may prevail from a smallpox hospital to some variable extent, no one will be prepared to deny. But it has been stated that infection may be conveyed to a surrounding population by aerial dissemination, diffusion, or convection; and those who believe that this has been proved for variable distances from a hospital, signify that this mode of transmission differentiates small pox from other infectious diseases.

In any epidemic of smallpox in a population, whether near to a hospital or not, the spread of the disease is due to infection either direct or mediate from an antecedent case, and in an average epidemic both of these modes operate in greater or lesser degree. The advocates of the theory of aerial transmission go further than this, however, in declaring that, added to these modes of infection which they frankly admit, there must be linked the possibility, nay, the likelihood, of transmission by the atmosphere.

Apart, for the moment, from the influence of a hospital, it must be acknowledged at the very outset that, whatever may be the characteristic which smallpox contagium possesses, it is capable of being transmitted aerially from one infected person, or thing, to susceptible persons for variably *short* distances. This is well proved. But when we come to consider the amount of distance through which smallpox effectively carries, or may aerially be effectively carried, we arrive at once at differences of opinion of an acute kind, because of the difficulty of leaving out of count the possible opportunities of infection by the more generally accepted means during the currency of any epidemic.

It would be impossible for me in the time at my disposal to deal with this subject as completely as it should be dealt with, owing to the enormous mass of material which has had to be reviewed dealing with those epidemics in which aerial convection of the disease was believed to prevail. I propose, however, to deal with the conclusions at which I have arrived regarding

this doctrine from a critical perusal of all the evidence of many epidemics and of other literature, leaving it to another place and occasion to put the grounds of my conclusions before the profession.

My conclusions respecting the first proposition, that smallpox hospitals, because of their vicinage to population, are a source of disease among persons in such populations, are as follow:

It appears to me well established that the mere existence of a smallpox hospital in relatively close proximity to a populous neighbourhood is a source of danger to the population, and tends to the spread of smallpox therefrom, and that infection may be, and has been, conveyed to outsiders, both directly and mediately. The reasons for this conclusion are these:—In the first place, and perhaps mainly, the hospital is the centre during an epidemic of a large amount of traffic. Ambulance traffic to and from, visits of friends and relatives of those afflicted to inquiry-room, and to wards, under certain general precautions, to see friends or relatives whose lives are in danger, "leakages" of various kinds from the hospital through the agency of the staff, workmen, tradesmen, cleaners, and others, under circumstances of imperfect supervision or from infringement of hospital regulations.

If we examine the records of the epidemics of Fulham, Sheffield, Warrington, Leicester, Orsett, and other places (epidemics, moreover, in which the aerial theory of convection has been invoked to account for the spread of the disease in the surrounding population), abundant evidence of imperfect administration, of structural deficiencies, or of other factors will be found.

In view, therefore, of the fallibility of all human rules and of the power of observing them, even the best hospital regulations break down more or less under stress of epidemic circumstances, and more especially when all the resources of the hospital are being taxed to their greatest, and when they are apt to be overcrowded.

So far most persons will agree; but when we critically examine the second proposition, viz., that smallpox hospitals near to populations exert a special capability to spread infection by the atmosphere, we are met at once by special difficulties, because there must first be eliminated the possibilities of spread by ordinary means. This cannot be said to be a trifling difficulty; but it has to be overcome before aerial convection may be considered at all. All those who have had practical acquaintance with the difficulties, in certain classes of population particularly, of obtaining accurate information for the three days which are indicated by the dates of their sickening as the dates of their having contracted infection, realise

how impossible this often is. Here the personal equation of the observer or inquirer comes into play. The memories of such persons are often at fault, and even if their memories are of the best, because of the possibilities of mediate infection, they may not be able to indicate any possible source of infection. Moreover, among the poorer classes of the population, information may be wilfully withheld for interested reasons, as it has been proved to be; ignorance regarding attack by the disease, because of its trifling symptoms, may exist; and there are the consequent chances of accidental relationships with unrecognised cases of the disease. All these are facts which are discoverable in epidemics.

The doctrine of the aerial transmission of smallpox is by no means a doctrine of the last thirty years. Dr. John C. McVail, in his paper "On the Aerial Convection of Smallpox from Hospitals" gives at length (Trans. Epidemiolog. Soc., Vol. XIII., pp. 38—42), an account of the inquiry initiated by Dr. Haygarth, of Chester, in the last quarter of the eighteenth century with respect to the transmissibility of smallpox by miasms, and of the controversy which arose therefrom, owing to answers to his queries by one of his correspondents, Professor Waterhouse of Cambridge, New England. To that I do not at present propose to allude, further than to say that Haygarth started his inquiry with the object to ascertain the views of his correspondents regarding what he himself held, that small-pox could not be aerially spread from room to room in the same house, and that, contrary to the doctrine of Paulet, if it were spread outside of the room it was by the agency of miasms, and not by actual contact. Haygarth believed that the something transmitted from smallpox was not particulate, but something dissolved in the air of a gaseous character. Waterhouse, however, had come to the belief in the value of isolation of smallpox cases, and practised it. Further, he believed in the possibility of aerial transmission. He declared "we have the clearest proof of the smallpox being communicated to the distance of several hundred roods, viz., from the hospital at West Boston to several families in the neighbourhood." The result of the correspondence between them was that, apparently, Haygarth converted Waterhouse to his way of thinking.

From time to time during the last century, there would seem to have been recrudescences of the aerial doctrine. In Thorne's Report on "The Use and Influence of Hospitals for Infectious Diseases" (Tenth Annual Report of the Local Government Board, 1880-81, supplement, p. 40), there are narrated several instances in which it was believed that aerial transmission existed, but in these instances ordinary sources of infection

could not be excluded. In addition to these are others, at Nottingham, for example, and at Leeds, in which no evidence of aerial transmission could be obtained, although in one of the cases it would have been welcomed as a reason for closing the smallpox hospital. In the Leeds case the smallpox hospital, which contained 118 patients, was situated from 36 to 200 feet from neighbouring dwelling-houses; and in the Nottingham case, smallpox patients were taken into a new wing which was immediately continuous with the workhouse buildings, and was bounded on one side by a narrow street. Although the windows of the smallpox wards were only 44 feet away from the opposite dwelling-houses, no evidence, after inquiry, could be obtained that smallpox was spread to the neighbouring houses.

A different complexion, however, was given to the aerial transmission theory by the Report of Mr. W. H. Power "On the Influence of the Fulham Smallpox Hospital on the Neighbourhood Surrounding It." (*Vide* op. cit.)

This hospital was exceptionally well-situated to test the possibility of aerial convection of smallpox, being well isolated from the surrounding neighbourhood by open spaces, such as athletic grounds, a cemetery, and unbuilt-on land. It was the point of convergence of two main lines of traffic by ambulances. The number of houses within 500 feet of the hospital was very small; outside the 500 feet limit, and up to the ¼-mile radius from the hospital centre, houses numbered only a few hundreds. Beyond that limit, houses encompassed the hospital on every side. To the south and west of the hospital in the direction of the Thames, Putney, and Hammersmith, the house-belt was in some parts comparatively narrow, but in other directions there was a continuous and dense population.

In December, 1880, an epidemic of smallpox broke out in the East end of London, and Fulham Hospital was called upon to house some of the cases. At this time the parishes of Chelsea, Kensington, and Fulham, which surround the hospital, were free from the disease. The central districts of London were as yet little affected by smallpox, the West end districts were relatively free. In the natural sequence of events, assuming a spread of the disease to take place, the West end districts would become affected only after the disease had invaded the central districts. The parishes of Chelsea, Kensington, and Fulham were not expected to show epidemic influence, for the reason that only a few months had elapsed since an epidemic in them had burned itself out (covering a period of four years) during which time nearly 2,000 persons had been attacked, and a much larger number had been protected by vaccination.

Fulham Hospital was used at first to house convalescent smallpox cases, but later fifty-five acute cases were also taken in. Of these fifty-five, only five came from Chelsea, Kensington, and Fulham; fifteen from Central London districts, and the rest from Islington and elsewhere. Power, in order to discover any relationship between the hospital and smallpox cases within these three parishes, drew an area around the hospital which contained several thousands of population, and which, at the same time, was sufficiently small to enable close study of the course of events. This special area was an area included within a circle of a mile radius from the centre of the hospital. The time-periods were fortnightly. Power was assisted in his inquiry by the local authorities of the different parishes. He believed at the end of his inquiry that few cases had escaped his observation.

It was on 13th December that the hospital was re-opened for these East end cases. It was not until three weeks had elapsed after the opening of the hospital that smallpox cases began to develop. Up till the 17th January, fifty-five cases, as has been said, had been admitted. By the 22nd of that month, the attacks from the three parishes numbered eleven, of which seven lived in the special area, six lived at least half a mile from the hospital, and five of them in houses widely separated from one another. In four of these direct or mediate sources of infection were likely; of the other three, the source of infection was not traced completely. One of these three had been regarded as a case of chicken-pox, and did not come under notice until later, when unmistakable smallpox broke out in the house in which one of these cases acted as servant. Respecting the two others, it was stated that they had not been out of the district for some weeks before, and they denied any knowledge of communications of any sort with the hospital. So far, therefore, there was no evidence to impeach the hospital. By this time, forty-eight cases of acute and twenty-two cases of convalescent smallpox had been admitted to the hospital.

During the next fortnight, however, a great outburst took place within the three parishes. The number of fresh cases rose at a bound to sixty-two. Of this number, forty-seven were in the special area; and of the rest, eleven lived within a further half-mile of the hospital. Fifty-six households were freshly invaded, of which forty-one were within the special area, and the other eleven within the further half-mile. Of these sixty-two cases, four only began to be ill before 26th January, while on that and four succeeding days forty-two persons were attacked. Of these forty-two, no fewer than thirty-two were of persons living within the special area, and other eight within one and a half miles of the hospital.

These thirty-two persons, then, must have contracted infection about the same time, that is within the five days Jan. 26–30. Power thereupon instituted a minute investigation of the day-to-day doings of these individuals, with the following results:—In nine, evidence was got, or reasonable suspicion could be entertained, of direct or indirect infection from previous smallpox. One was from a house in which a case of the disease had already been removed to hospital; a second had been at a house where there was chicken-pox; a third was the blind-maker to Fulham hospital; a fourth lived in a street in which smallpox had been a fortnight previously; a fifth worked near the hospital, and had been drinking beer with ambulance men in a public-house; and the four others had had business in quarters of London in which the disease was prevalent. Of the remaining twenty-three, scarcely a hint was obtainable which could be said to account for their attack; all denied any knowledge of having been exposed to infection of smallpox, none could remember any kind of communication with the hospital or with persons connected therewith. Even in view of these facts, Power could not say that there had been revealed any evidence that the hospital had been any factor in their production: "indeed, it was seen to be quite possible that the outburst in question had been the result of a congeries of unrecognised accidents in no way immediately connected with the hospital, but which were peculiar to the particular moment. Unless, therefore, it could be shown that in other years during which the hospital was in use for smallpox there had been exceptional incidence of the disease on the special area around it, occasion for believing the hospital to have been concerned in the outbreak of 1881 did not of necessity arise."

Accordingly, resort was had to the study of the facts of former years so far as they could be ascertained generally. Power admits with reference to this subsequent inquiry that "investigation into the behaviour of smallpox in the three parishes during former years could not be made so complete as the inquiry into the facts of the current epidemic." Records, however, were available of the cases treated in hospital, but there was no complete record of those treated in private houses.

As the result, generally, of this later inquiry, Power found as follows: Fulham Hospital was opened on 10th March, 1877. In November, 1876, smallpox became widely diffused in London, and it began to spread in the three parishes of Chelsea, Kensington, and Fulham. In December, indeed, between 30 and 40 cases therefrom had to be taken into a hospital. By March, 1877, although smallpox continued to prevail to the highest point, it had also increased in the three parishes, and continued to prevail

therein until July, when it began to decline. In the 21 months from March, 1876, till the end of December, 1877, 476 houses in the three parishes were invaded, of which 148 were in the special area, and 328 in other parts of the parishes outside the special area. "In these figures," says Power, "there is no suggestion whatever of exceptional incidence of smallpox on the special area which contains Fulham Hospital." Out of these 21 months, in 9 only could Fulham Hospital exercise any effect upon the surrounding neighbourhood: consequently, the inquiry narrowed itself down to these 9 months. Based on the attack-rate per 100 houses, it was found, taking the parishes as a whole, that the attack-rate before the hospital was opened, was ·41, and after, ·94; in the special area, before, ·15, after, 1·10; and in the remaining parts of the parishes, before, ·54, and after, ·86. Power concluded, therefore, that the increase in attack-rate within the special area after the hospital was in use, amounted to from seven to eight times more than it was prior to that event, and in the rest of the parishes it was nearly doubled.

During the epidemic period January–August, 1878, the hospital being in active use for the treatment of smallpox in London in January of that year, cases of smallpox began in March to appear in the three parishes, which since the previous autumn had been free from the disease, and they began to contribute in excess of other parishes. In the fortnight ending 20th April, no fewer than 81 cases were sent from them into the hospital. From early January till the end of August, 368 houses were invaded in the three parishes, of which 211 were in the special area, and 157 in other parts of the parishes. Attack-rates per 100 houses during this period were respectively 1·80 in the special area and ·67 in the rest of the parishes.

Generally speaking, the same course of events was observed during the epidemic periods of 1878–9, and of 1880.

Following the same line of inquiry respecting the epidemic on which he made his report to the Local Government Board, with the advantages of personal investigation of the known cases, and after delimitation of the special area into (1) a central ring or circle within a quarter of a mile; (2) a ring a quarter to half mile; (3) a half to three quarter mile ring; and (4) a three-quarter to a mile ring; the relative gradational incidence of cases as the hospital was approached was the same as in former periods. He notes that in certain periods, particularly that ending February 19th, 1881, although there was a diminution in the absolute amount of smallpox, the ratios of percentage invasions remained the same. "If," he argues, "the spread of smallpox had been from one infected

house to another, or if it had been by distribution from the hospital by way of ambulances, visitors, and the like, this minor incidence was hardly to be expected." From maps, showing the distribution of cases, the ambulance routes, the railway station at which friends and relatives of patients in hospital arrived within the hospital area, he points out that the distribution of cases around the hospital was notably uniform in direction, and did not affect specially lines of human movements. He came to the conclusion that this unexpected fact was in harmony with the other fact, that out of the thirty-two persons attacked in the outburst at the end of January, twenty-three of them could not be shown to have had associations with the hospital, its staff, or with antecedent cases of smallpox, so far as could be ascertained. Of the twenty-three cases, he gives the following illustrations of the kind of persons attacked: (1) that of an unvaccinated infant who for a month before had not been out of the house; (2) that of an invalid lady who had not been out of her house since the previous September, and who was attacked on 30th January. Twelve of these twenty-three cases were investigated separately by Dr. Dudfield, the Medical Officer of Kensington, in whose district they occurred, and he likewise failed to find any trace of antecedent source of infection.

Power's final conclusions on the whole matter regarding Fulham Hospital are these: "Since the establishment of Fulham Hospital, the several sections into which the special area has been divided have suffered an incidence of smallpox varying with the closeness of their relation to the hospital. The small circle containing the hospital, and having few dwellings a quarter of a mile distant therefrom, has suffered in such dwellings as it contains much in excess of the second ring, and the second in excess of the third. So that for the whole period there is something like a doubling of the smallpox incidence, section by section, progressively from the circumference of the special area towards the centre, where the small circular section containing the hospital is seen to have suffered an incidence approaching to eight times that of the third or outer ring. And this is not all; for, given a particular epidemic with a certain degree of smallpox incidence on the several sub-areas, it will be found that another epidemic with the double or half of this degree of incidence on the whole area results in an almost doubling or halving of the several gradations of incidence upon the several parts of the area. Finally, it is strikingly apparent that the degree of smallpox incidence on the whole special area with the related gradations of incidence on the several sub-areas has again and again, since the initiatory epidemic of 1877, been singularly exactly proportioned to the operations of the hospital as measured by the admissions thereto of acute smallpox cases."

Power fully recognised respecting this hospital that there were sources of infection from the hospital which could not be blinked. For example, friends were admitted to see dying patients, although they were made to wear an over-all dress. Very particular regulations had been laid down for observance by the hospital staff. Tradesmen were liable to come in contact with sources of infection in the persons of members of the staff whom they chanced to meet about the steward's office. Of these, however, he says none are known to have conveyed infection to their homes without themselves suffering from the disease. At the same time, two non-revaccinated tradesmen took smallpox during the currency of this epidemic: one a dustman, who himself was taken ill 13 days after his visit to the hospital, and who infected two of his sons and a lodger in his house; the other being the hospital blind-maker. There were complaints of ambulance men drinking in public-houses. It will be recollected that the source of infection in one case was attributed to this cause. Power, recognising these possibilities, nevertheless concludes that they could not explain the facts. Neither could ambulance routes do so, for 20 to 30 houses away from the lines of route were attacked in different directions.

He was of opinion that the hospital influence might have been accelerated by the atmospheric conditions prevailing at the time. During the January outburst "a period of severe frost, characterised by still, sometimes foggy, weather, with occasional light airs from nearly all points of the compass" prevailed, and it was noted that ozone was present in the atmosphere just before, was absent during, and reappeared at the end of the period in which sufferers became infected. Another contributory factor in atmospheric dissemination which he suspected was the concentration of smallpox in a hospital, especially under certain ill-defined conditions as to potency and intensity of contagium.

In the later epidemic period of 1884–85 also, there was repeated the same story as to incidence as that of the former outbreaks.

In Dr. G. S. Buchanan's report to the Local Government Board on Epidemic Smallpox in the Orsett Union in 1901–02, p. 26, that writer cites as examples of smallpox epidemics in which graduated intensity of incidence from hospital influence has been observed, in addition to Fulham, with which I have just dealt, the epidemics of Sheffield in 1887–8, of Oldham in 1893, of Warrington in 1892–3, of Bradford in 1893, and last of all that of Glasgow in 1900–1.

I propose only to give some facts and my conclusions respecting these from a full and critical investigation of their details.

Sheffield Epidemic of 1887–8.—Barry's Report of this epidemic is the main source of my facts. It deals with the material collected from the house-to-house visitation of some 60,000 houses, and takes minute account of over 6,000 cases of smallpox, and of about 600 deaths. Sheffield, with its population of 300,000 persons, was very ill-prepared for this epidemic. It had a borough hospital for infectious diseases with sixty-four beds, but this was considerably overcrowded during most of the worst period of the epidemic. Close by it were many inhabited houses of the poorer types, and extending for over 4,000 feet from it to the north-east, east, and south-east was a dense population. In the correspondingly western direction houses were fewer and of better class. During the currency of the epidemic, it was found that the houses within circles of 1,000 and 4,000 feet from the hospital became attacked almost simultaneously and suddenly to a degree amounting to eightyfold and a dozenfold respectively, while the incidence of the disease upon those living within a series of zones around the institution varied precisely as the distance from the hospital varied. At the time of outbreak of the epidemic, the special area round the hospital was absolutely free from smallpox. During the first two months of a small prevalence, the incidence of the disease in the borough was almost confined to those parts of it outside the special area, the hospital during this time being hardly or not at all in use. When, however, it began to be filled with patients, a smart outbreak took place in the immediate vicinity of the hospital, while half-a-dozen cases only occurred elsewhere throughout the whole borough. Indeed, during one complete fortnight, whilst cases were multiplying within the special area, only one case was attacked in the remainder of the town. Thereafter, fortnight by fortnight, it steadily developed within the special area, and thence spread to the outer zones, until eventually a large epidemic raged over the whole borough.

There cannot be the least doubt that in this epidemic the hospital did more harm than good to the town of Sheffield. There were some of the gravest faults of administration exhibited, and facilities for the spread of the disease within the special area in this way from the hospital were very great. There seems to me to be no evidence which would support the view that in this epidemic aerial dissemination of the disease was a factor. There is, on the other hand, in connection with some of the other institutions in that town which were used for smallpox, good reasons for distinctly negativing the view. These may be named. The Sheffield Guardians threw open certain of their buildings for smallpox within the workhouse grounds. The buildings for smallpox were only from 130 to

180 feet distant from the general infirmary of the union. Sixteen persons, inmates of the workhouse, took smallpox, but Barry says of these "that defects of workhouse administration have in all probability been mainly responsible for the smallpox which occurred in that institution, and that belief in direct atmospheric conveyance of infection from the hospital to the workhouse is not necessary in explanation of the smallpox there."

The same conditions, if not more accentuated with reference to related positions of smallpox buildings to general workhouse buildings, obtained in connection with the Ecclesall Bierlow Union. Twenty-six persons in the buildings neighbouring the smallpox buildings were attacked. Regarding all these cases, Barry concluded that there was a strong probability that their infection was derived from communications of one sort or another with the smallpox hospital in the grounds.

Here, then, are two institutional populations living in very close proximity to smallpox wards, which were overcrowded during a considerable period, and direct or mediate infection is able to account for all the cases attacked. Surely if aerial dissemination prevails as a necessary sequent of concentration of smallpox cases, it ought to have exhibited its influence in these cases.

It appears to me, therefore, that aerial dissemination did not take place from the borough hospital; at least, it is not proved. And it is proved that it did not exist in the case of the Sheffield Union and Ecclesall Bierlow Union.

Oldham Epidemic, 1888.—Careful consideration of the facts relating to this epidemic confirm the conclusion at which Dr. Niven arrived on investigations of the facts upon the spot. In this epidemic, the first case attacked in the neighbourhood of the Westhulme Hospital was a lady who had had a mild attack which was not at first recognised, indeed, not till after she had infected her infant and husband. There were found during this epidemic unrecognised cases which were going about for some time after attack.

A common lodging-house was infected, and several cases were derived therefrom. The very first case in Oldham was in the person of a tramp. Dr. Niven found, during his inquiry on the individual cases, that all the known cases fell into fairly well-defined groups, that in some of these groups, undoubtedly forming foci of infection, were cases which were either entirely overlooked or were overlooked for varyingly long periods. He prepared certain tables, one showing the groups of cases, and another

indicating the proportion of infected houses to total houses in different areas round the hospital and other points as centres. Niven's conclusion on the whole subject, in the light of his facts, was that "there is not sufficient evidence to charge the hospital with causing the cases in its neighbourhood. . . . . . The cases admitted into, discharged from, and which died daily in the hospital from January 1st to September 30th, 1888, only serve to show that so far as mere numbers are concerned, they were enough, on Power's scale, to spread the disease aerially, and that when most cases were in the hospital, the disease was not conveyed aerially to Burnley Lane, in spite of winds and other conditions favouring." He arrived at a similar conclusion respecting the outbreak of 1892–3.

Warrington Epidemic in 1892–3.—Reported upon by Dr. Thomas D. Savill. (Vaccination Commission. Fifth Report, Appendix V.)

From May, 1892, till May, 1893, the number of cases of smallpox was 667, the epidemic being at its worst between September 10th and December 3rd, 1892. The Notification Act was adopted very early in Warrington, the Warrington Act coming into force in July, 1879. The population numbered, on estimate at Midsummer, 1892, 54,000, and the number of inhabited houses, 10,000. The extent of the epidemic was due in the opinion of Savill to the following reasons, viz.: (1) Non-recognition of the earlier cases; (2) Deficient hospital accommodation; and (3) Deficiency of re-vaccination.

Smallpox was introduced into the neighbourhood of the town by the family of a farmer, who removed thither shortly after an illness by one of his employees of what was called by the medical attendant "Measles." The farmer, his son and daughter were attacked a day or two after their arrival. After five days' delay, they were removed to hospital (the wife accompanying them, though not attacked). Their house was disinfected. The man who did this duty was attacked later. No more cases occurred till 26th July, when a navvy in a common lodging-house in Warrington was taken ill, and a rash appeared on his body. The owner of the house, being suspicious of the nature of the rash, walked the man through the streets to the hospital, where he was detained. He was very ill. During his delirium he escaped the vigilance of the nurse, fled from the hospital, and before he was caught and brought back, had been at large in the town for six or seven hours. He was found by a constable nearly a mile from the hospital, and was brought back on foot. The man's case constitutes Group I. of Savill's groups.

During August a series of cases, as was afterwards proved, developed in the town. At first these were mistaken for German Measles and were treated at home, during which time plenty of facilities for intercourse in different ways was afforded. Around one of these cases, no fewer than 23 others infected were grouped from this common origin. The total accommodation available in the Borough Infectious Diseases Hospital at the commencement of the outbreak was 30 beds. For want of accommodation only 13 cases of smallpox could be received into hospital, and even then only by dangerously overcrowding the place. Sixty cases, in consequence, were left at home, these homes being scattered over the town. Primary vaccination had been well attended to in this population. It was estimated that 99·2 per cent. of the entire population had been vaccinated in infancy. Re-vaccination, however, had been neglected.

The Borough Hospital was close by inhabited houses. The street which led to its gates contained 79 houses and a population of nearly 800 persons, all of the working classes. Within a radius of 300 yards of the hospital, there was a population of 3,394 persons, not including the inmates of the workhouse, which was immediately adjoining the hospital. There were three open spaces around the hospital, where the children played and the neighbours gossiped.

The workhouse, to be more exact, was only 125 yards away from the smallpox block of the hospital. It had a population of 712 persons. In all, six cases of smallpox developed in it during the epidemic, and in all of them could a history of direct or mediate infection be tracked. It might be thought that this relative immunity was due to re-vaccination; but prior to the 19th September, when the smallpox cases were shifted to the new temporary hospital in Dallam Lane, only 59 of that 712 were protected by re-vaccination. In spite, therefore, of its proximity to the smallpox hospital, and of this other circumstance, only ·8 per cent. of the inmates were attacked, compared with 1·2 per cent. of the whole town. "Nor," adds Savill, "was there any other condition which could have prevented these persons from contracting the disease aerially had the principle of aerial convection been in operation."

The patients having now been removed to the new temporary hospital, a new set of circumstances was initiated whereby to test once more during the one epidemic the operation or non-operation of this aerial influence. The new hospital was by no means free from imperfections. It had no disinfector, consequently the clothes of the smallpox patients had to be sent to the old hospital for disinfection, and had to be brought back again; there were structural defects of a grave kind which enabled communica-

tions between the infected and non-infected to take place; and it was surrounded by a paling through and over which children climbed, and persons conversed and shook hands with convalescent patients. Around the paling boundary was the general play-ground of the children and the loafing-ground of the neighbourhood. Houses, to the number of thirteen, were within 100 yards of the centre of the hospital wards, and a total population of 1,075 persons within 500 yards. Of these 1,075 persons, 112, or 10·4 per cent. became infected during the months of October, November, and December. Savill worked out a table showing, first, the number of infected houses, the total number of houses in each area, and the percentage number of houses infected in a series of 100-yards zones up to 500 yards, and the same in relation to the quadrants, north-west, north-east, south-west, and south-east.

In the former it was shown that there was a certain gradational incidence as in former epidemics in other places, but that the percentage of houses infected in the 300–400-yards zone was greater than in that of 200–300 yards, whereas in the quadrant areas, the incidence was greatest in the south-east quadrant, next in the south-west, next in the north-west, and least in the north-east.

Looking at the question from the point of view of wind-direction, it was found from observations taken at the old hospital, 1,000 yards off, during October, November, and December, that the wind blew from the south-west on 32 days and from the south-east on 22 days, out of a total possible of 92 days. In other words, on 54 days the wind was from south-west and south-east. On the remaining 38 days it blew from the north on 8 days, from the north-west on 20 days, on one day from the east, on one from the south, and on 7 days from the north-west. If, therefore, other causes are excluded and aerial convection had prevailed, the north-east quadrant should have been most attacked, next the south-east quadrant, next the south-west, and least of all the south-east. But the actual result shows the very reverse: the south-east quadrant shows 14 per cent., the south-west 10 per cent., the north-west 9 per cent., and the north-east 6 per cent. Hence it would appear that the number of infected houses bore no relation to the direction of the wind.

Further investigation was made concerning the incidence of the disease among the workers in different works within 500 yards of the hospital, with the following result:—

There were ten of these works or factories within 500 yards of the hospital. The chief occupations were iron-making, fustian or velvet cutting, and brewing. The workers were for the most part adults, who

were healthy, and who had been primarily vaccinated. Generally speaking, there was seen to be a greater incidence upon the workers in the works nearest the hospital; at any rate, those within the 250–320-yards zone were more affected than those within the 400–500-yards zone. The Dallam Iron-work and the Dallam Brewery were both within the 300-yards radius, and both abutted on the lane from which entrance led into the hospital. The case-incidence in the iron-work was 3·5 per cent., while in the brewery it was only 1·1 per cent. Further investigation showed, however, that there were causes operating upon the workers in the iron-work which did not affect the workers in the brewery. There was proof that direct and mediate infection accounted for the higher rate found among the iron-workers than among the brewers. It has to be noted that it was not re-vaccination which protected the brewers, for they were not re-vaccinated until November 17th and 24th, when the bulk of them were done.

Savill's conclusions on the whole subject of this epidemic were, that the sources of direct and mediate infection were so common that there was no need to have recourse to the aerial theory to account for the outbreak and incidence of spread; that the disease seemed to spread directly along the lines of human contact; that the exemption of two large communities as the inmates of the workhouse and the employees of the brewery seemed to be against the view that conveyance by aerial currents was in operation at all. "On these grounds, therefore, and in view of the facts set forth in (his) Report," says Savill, "it may be affirmed that the diffusion of smallpox by aerial currents as above defined was not an appreciable factor in the Warrington epidemic; and further, that a close examination of the facts renders it unnecessary to assume any such hypothesis."

Glasgow Epidemic, 1900–1902.—*Vide* Report by Dr. Chalmers, Medical Officer of Health.

The history and progress of the outbreak was, shortly, this: Small-pox was introduced into the city in April, 1900, attained its maximum prevalence between January and March, 1901, began thereafter to decline, and the last sickening occurred on 29th June of that year. Early in November, however, it re-appeared, and during the spring months of 1902 it displayed considerable vigour. It still continues in the city. The number of cases recorded during the pre-epidemic period (between 21st April and 29th December, 1900) was 397; between 12th January and 13th July, 1901, 1,389; and between 16th November, 1901, and 3rd May, 1902, 469: in all, therefore, 2,255 cases.

From the early winter of 1897 until the outbreak in April, 1900, the

city was practically free from indigenous cases of smallpox, although an occasional case was reported from without. Smallpox, however, reappeared under the following circumstances: In an overcrowded one-apartment house in one of the poorest parts of the city (Calton), a man was found by the Medical Officer of Health to be suffering from a confluent attack, the symptoms indicating that the disease was well advanced towards the end of the second week. He had not been brought under medical observation until the day preceding, viz., the 9th of April. The patient had been a seaman on board the s.s. Hispania, which arrived at the port of Glasgow on the 18th March from Bombay, *viâ* Liverpool. The Medical Officer of Health of Liverpool had advised the Glasgow Sanitary Authority of the occurrence of smallpox on board this ship while in the port of Liverpool. In consequence, the crew of the ship while in Glasgow were kept under observation from 18th to 21st March, the time the ship lay in Glasgow. It was reported to the Medical Officer of Health of Glasgow that this man had been successfully re-vaccinated at Liverpool, and that he had sailed with the Hispania again on her outward voyage on 21st March. From facts ascertained some months later, however, it appeared that an unsuccessful attempt at re-vaccination had been made on him in the month of February while on the voyage from India, as smallpox had broken out on the ship. That he did not sail with the Hispania, although he had signed articles to do so, was proved by the subsequent history. After removal from the house in which he was living to hospital, he died.

Up till the 23rd April, no fewer than 11 cases were found to have been directly infected from this man, and of these some were residents on the common stair, some were inmates of the same house, one was his medical attendant, and one was a pawnbroker's assistant, in whose establishment articles from the house had been pledged. In all, five houses were invaded, in four of which overcrowding prevailed. Some of the infected persons had in the interval removed to other districts of the city, one had been lodging in a common lodging-house, another who had been living in the first infected house, left before the exact nature of the first patient's illness was discovered, and in the interval she had lived in three different places, for part of the time in two different private houses, and for part in a lodging-house. She was found to be suffering from smallpox when she presented herself for treatment at a public medical dispensary. Another was a worker in a rag-store. So far, therefore, it will be apparent from the distribution of the cases found, their migratory habits, their occupation, their connection with common lodging-houses, and the delayed recognition of their illnesses, that there was the making of an epidemic.

Fortnight by fortnight the number of cases increased, their incidence being first in the eastern district of the city in which is the smallpox hospital, and also in other districts of the city. The northern district was soon involved, and, later, was the area of a comparatively large centre of the disease. From the whole history of the epidemic, there were evidently unrecognised, ambulant cases of the disease going about. Men were attacked in public offices, infected from fellow-employees who were continuing at work while suffering from the disease. A group of cases in High Street was found whose infection was due to an unrecognised, non-medically attended, case of what seemed to have been hæmorrhagic smallpox; persons were found pursuing their vocation with the evidence of mild attacks of smallpox on their bodies.

During the fortnight ending 2nd of June, a definite attack of the eastern district of the city took place: in Steven Parade, a street immediately to the west of the smallpox hospital, and in streets in Bridgeton. At the end of the month, a congeries of cases occurred in London Road, due to the presence of undetected smallpox in a household in a tenement. In this tenement there were found eleven cases in seven households, and from the same source, five more cases were discovered, three of whom lived in the eastern, and two in the northern district.

During July and August, cases began to sensibly decline in numbers, but gradual dissemination of the disease continued by reason of unrecognised ambulant cases. It again became more active, as was expected, towards the end of November. It prevailed in other parts of the town as well as in the eastern. The City Poorhouse was invaded, evidently from undetected disease in a visitor to that institution. By mid January, 1901, the true epidemic period of the outbreak was reached. Milder forms of the disease, unrecognised, were common all over the city. On New Year's Day, for example, a case was reported in a street on the south side. Investigation of this case revealed that unrecognised cases of the disease existed in a house in Argyle Street, in the heart of the city, from which one case had developed smallpox in Aberdeen, one in Morayshire, one was pursuing her occupation in a public tea-room in the city; and so on. In short, it was found that this house had been in an infected state for five weeks prior to the New Year. Seven cases were known to have been infected from this house.

By the end of January, a violent outburst occurred. During the fortnight ending 26th January, 350 cases were reported, of which the eastern district alone contributed 256 cases, the rest being fairly distributed over the city. These cases formed two groups: one in the eastern and the

other in the southern district. Dr. Chalmers in his Report says of this outburst, that it required two factors to account for it, the free movement of mild unrecognised cases, and a susceptible population. Of 308 cases, the dates of whose sickening were known, it was found that 256 were infected about the Saturday of the New Year holidays, the 5th of January, when there is free movement about the city of large numbers of persons. "The outbreak" says Dr. Chalmers "is definitely related to exposure to infection during the holiday season. The localities involved correspond very closely with those in which isolated cases of the disease were known to have been occurring for some considerable time past; in those districts, therefore, there has been a succession of cases quite unrecognised owing to their mildness, but gradually, from their numbers, acquiring an explosive intensity, which only required a suitable occasion to show itself. This came with the holiday season, when intimate commingling occurred, and the mild cases had for the time being a newly established relationship." Then followed a temporary lull for four weeks, but in the last week of February, increase in prevalence was observed, which extended over a period of three weeks. From the 26th of January till the 9th of March, the total cases recorded was 978, of which the eastern district alone contributed 646, the southern 133, and the central 84. Put in other words, the eastern district showed per 10,000 persons an attack-rate of 13, the southern 2, and the central less than 3. After the end of March, small-pox was on the decline.

The city was quite free from smallpox from 29th of June till a new outbreak made its appearance in the northern district of the city in early November. An unrecognised mild case was once more the beginning of the mischief. The man attacked was a spirit salesman. He felt ill, and his ailment was called measles.

It was not till the 6th of November that diagnosis of smallpox was made by the medical officer of health, whose opinion was asked owing to some doubt as to the exact nature of the illness. The man was removed to hospital. By this time a little over 400,000 out of a total population of over 600,000 persons had accepted the offer of free vaccination, or had had the operation performed privately. By the end of November five cases were reported, one from a model lodging-house, the rest being associated with an address in Possil Road, a street in the extreme north of the city. It appeared that the man from the lodging-house was infected from the same address. During the enquiry into these cases, another was found who had sickened about the end of October, whose case during all the interval had never been detected, and who had been going about as

usual for most of the time. During the next fortnight ending the 14th December only four cases were reported. One was in the person of a patient who had evidently contracted the smallpox in London. He arrived in Glasgow from Tilbury in the Orsett Union, in which at the time smallpox was prevailing, on the 29th November, and sickened the following day. Two others were from the tenement in Possil Road, and in the fourth no antecedent source of infection could be discovered. A comparatively large infection took place in a model lodging-house in the northern district, due to a man who had been suffering from a mild unrecognised attack. From him twenty others were infected, and of these two were then living in other lodging-houses, one was a bed-maker in the same lodging-house but lived outside, one lived in Possil Road, and one in the east-end. Moreover, one of the two lodging-house residents lived in a lodging-house in the eastern district. The City poorhouse was again invaded, by the introduction of one who had been infected from a lodging-house. During February but few cases occurred in the eastern district, the model lodging-house in the northern district supplying the majority of cases. Of the eastern cases, one was the father of a child regarding whose illness attempt of concealment was made. By the end of that month, a further explosion of the disease in the eastern district took place. Of the 147 cases recorded in the fortnight ending 22nd February, no fewer than 102 were found to be in that district. By the end of the first week in March, however, the eastern recrudescence had gone down largely. A limited outbreak took place in connection with a hotel in a western district, twelve cases being attacked. One of the eastern cases was that of a woman who was employed in the hospital wash-house, and who had not been re-vaccinated before being employed. Thereafter the epidemic began to decline, and by the beginning of May but few cases were being fortnightly reported.

Attack-Rates.—The eastern districts had higher attack-rates than any of the other districts of the city. In the Greenhead and London Road district (No. 7) it was 9·9 per 1,000, fully six times greater than those of other districts, and fully four times that of the city generally; Barrowfield District (No. 8) came next with a rate of 6·4 per 1,000; District 11, in which the outbreak began originally, came third. Viewed from the point of view of cases to population, District No. 7, with a population of 66,297, had 660 cases; No. 8, with a population of 27,696, had 179 cases; while the Bellgrove and Dennistoun District (No. 5), with a population of 79,211, had 224 cases. These are districts in the eastern end of the

the city, the population of Bellgrove and Dennistoun District being, however, of a better class. But districts far removed from the small-pox hospital had by no means few cases: that of Hutcheson Square, for example, with a population of 70,229, had 146 cases; and that of Kingston (No. 19), with a population of 40,407, had 63 cases. Both of these districts are on the south side of the river, and are much further removed from the small-pox hospital.

Hospital Influence.—Dr. Chalmers constructed a Table covering several years, during which small-pox was epidemic in Glasgow. This Table is here reproduced.

Proportion from each Administrative District of the Total Cases of Small-Pox occurring in Glasgow in Several Years.

Year.	Total cases.	Percentage of Total Cases.						
		East.	Central.	South.	North.	West.	South-Side.	N'th-West.
1900—1901	1,759	60·4	12·3	13·6	7·0	3·0	3·1	0·6
1892	78	28·2	19·2	26·9	3·9	20·5	1·3	...
1893	386	45·9	24·7	9·7	12·8	3·8	0·8	2·3
1894	49	32 7	36·7	16·3	8·2	2·0	4·1	...
1895	243	33·4	14·0	9·0	5·8	36·2	0·8	0·8
1896	5	...	...	...	...	...	...	...
1897	59	57·6	3·4	32·2	5·1	...	1·7	...
Percentage Population, 1901.		23	15	17	22	8	8	7

Of this Table, Dr. Chalmers remarks that "in each year in which small-pox has been present the proportion of cases contributed by the eastern district has been uniformly in excess of the proportion of the population residing there"; and he adds "the central, southern, and western divisions in occasional years present a similar excess, but this is due in most cases to the circumstances under which the several outbreaks were introduced. The excess in the eastern district is constant, and in none of the other districts is this feature present."

The prevalence of the disease in the eastern district in the present epidemic took place when the number of cases in the Small-pox Hospital was comparatively limited. Dr. Chalmers argues that it is reasonable to assume that if a simple aggregation of small-pox creates an element of risk to surrounding populations, that risk should increase with the density of the aggregation, with the result that an exaggerated prevalence ought

to be noted in those districts most exposed to that influence, and in excess of those districts which are beyond its influence. In the preceding Table it is clear that, based on the form of reckoning used in the Table, in the present epidemic the eastern district showed by far the highest proportion of cases. The same is true of the years 1893 and 1897, but is only relatively true of 1892, for in this last year the percentage of total cases for the southern district very closely approaches that of the eastern. In the years 1894 and 1895, this increased proportion in the eastern district relative to other districts is not maintained: in the former of these two years the central district, and in the latter the western, contributes respectively higher proportions than the eastern.

In attempting to obtain any indication of relationship between the volume of infection contained within the Small-pox Hospital, distinct from the volume of infection which may be reasonably assumed to follow in the wake of a converging stream of patients and infected clothing, together with the opportunities of contracting infection from non-detection or delayed recognition of mild cases, Dr. Chalmers says that if a numerical relationship is established between the cases which occurred before, and those which occurred after, the beginning of 1901, a figure of 1 to 3·5 would express the proportion for the city generally. Compared with that proportion, the corresponding proportion for the eastern district would be 1 to 3·9, that for the northern district 1 to 3·6, and that for the southern 1 to 4·9. Put in other words, the proportional figure for the southern district shows a five-fold increase during the epidemic period, that for the eastern district a four-fold increase during the same period, and negligible differences are apparent in the proportional figure for the northern district. It has further to be observed that the cases in the southern district are much further removed from the Small-pox Hospital than any part of Bridgeton which is nearest the hospital. The only legitimate deduction from these facts, therefore, is that while the proportional figure for the eastern district is relatively high, the operation of widely distributed opportunities of infection, known to exist during the currency of the pre-epidemic and epidemic periods, has to be seriously reckoned with.

From a consideration of the proportion of the cases in the eastern district during the epidemic period, particularly of those in the four weeks ending 23rd March, there would seem to be some suggestion of a definite time relationship with the numbers under treatment in the hospital. By the 8th March the maximum number of cases in hospital had been reached, viz., 522. When, however, a comparison of the fortnightly admissions with the numbers in hospital is made, the temporary impression

admissions with the numbers in hospital is made, the temporary impression is dissipated. For example, 67·5 per cent. of the cases occurring in the fortnight ending 16th June, 1900 happened at a time when the number of patients in hospital was 67 only. Dr. Chalmers' conclusion was that the material of this epidemic did not warrant him in saying that the infection of a neighbourhood contiguous to a smallpox hospital was in any definite way proportioned to the volume of infection within the hospital. When the unexpectedly large number of cases broke out in the east end of the city, in the immediate neighbourhood of the Smallpox Hospital, the number of cases in hospital barely exceeded 30 daily. Later, increase of numbers in hospital was associated with increase of numbers in its neighbourhood, but the proportion to the total volume varied on each occasion only by a few per cent., while the numbers in hospital were multiplied from six to sixteen times. While, therefore, it might be supposed that there was a general correspondence between the proportion of cases occurring in the neighbourhood of the hospital, and the numbers dealt with in hospital, no such correspondence was discoverable during the epidemic period, or even during the period of the rising epidemic. On this point Dr. Chalmers says: "The investigation throws no light on the channels through which influence is exercised, except what is of a negative character. The eastern cases began when there was no pressure on ward space; they re-appeared at a period of the recrudescence when this was being specially guarded against; and but few of the cases in this period recurred in formerly infected tenements. The topographical relationship of the hospital to the surrounding population outside the quarter of a mile radius does not admit of any discrimination between the effect of aggregation and the precedent volume of traffic, both in patients and infected clothing, through the main thoroughfares of the infected district. But a survey of the whole circumstances leads inevitably to the conclusion, that the excessive prevalence in the eastern district has established the unsuitability of Belvidere for the continued treatment of smallpox."

One feature of this epidemic (repeated, moreover, in other recent epidemics elsewhere) remains to be mentioned. The number attacked between the ages 25–35 was much in excess of the number at any other age-period. From this fact alone, the lesson which the epidemic teaches is that communities who rely solely on primary vaccination in infancy cannot be expected to present an immune front to smallpox contagium.

Epidemic in Orsett Union, Essex.—September, 1901, to June, 1902. (*Vide* paper by Dr. Thresh on "Smallpox Hospitals and the Spread of

Infection," Trans. Epidem. Soc., London, Vol. XXI., N.S., p. 101, *et seq.* Report to Local Government Board on "Epidemic Smallpox in the Orsett Union, 1901–02," by Dr. G. S. Buchanan.)

The district embraced under the Orsett Union in the County of Essex has been the arena of different epidemic attacks of smallpox during the last decade or more. It suffered to some extent in the pandemic wave of 1871; again in 1877, when the disease caused 16 deaths; again in 1884 and 1885; again in 1892–93, when between 60 and 70 cases were recorded; a few cases appeared in 1894, 1895, and 1896; two cases in 1898; and two in 1900.

But between 1897 and 1900, with the exceptions above noted, smallpox was unknown in the Union. The outbreaks in 1893 and in 1895 were attributed to infection from the floating Smallpox Hospitals of the Metropolitan Asylums Board, which are anchored in the Thames off Purfleet, having been placed there in 1884.

During the epidemic of 1901–02, that under special consideration, of the 17 parishes which compose the Union of Orsett, 12 were more or less invaded, those unattacked being agricultural parishes along the northern boundary of the Union.

The number of smallpox notifications from August, 1901, till April, 1902, both inclusive, was 443, of which 117 occurred in the parish of West Thurrock, 157 in Grays Urban District, the next highest number being in East and West Tilbury, 31 in South Ockendon, 28 in Aveley, 31 in Stifford, 18 in Orsett, and smaller numbers in the others.

Geographically, the Union extends from east to west for about fourteen miles, and from north to south for about seven miles, the Thames forming its southern boundary. The most populous parts of it are those by the river, especially Grays Urban District, the parish of West Thurrock to the west of Grays, and the parishes of Little Thurrock and Chadwell St. Mary to the east of Grays. In these localities are many works by the riverside, chiefly cement works. In the parish of Chadwell are the Tilbury Docks. The Orsett Rural District is mainly agricultural, but some of the inhabitants of it repair daily to their work in these works by the river. Purfleet is nearly opposite, but a little to the west of, the hospital ships, which are, however, moored nearer the opposite side of the Thames. It contains chalk quarries, paper mills, oil and storage works, and saw-mills. It therefore attracts for employment many persons from different parts of the district, who working daily in the works live in other parts of the Union. Between Purfleet and the hospital ships is moored the reformatory ship Cornwall, and to the west of the hamlet

of Purfleet are the barracks containing the garrison. It will thus be seen that the population most affected during the epidemic was that along the riverside districts.

The population of West Thurrock numbers 2,585, and had 117 cases, the population of the rest of the Union was 30,578, and had 321 cases. The attack-rate per 1,000 in West Thurrock, therefore, was 45, and in the rest of the Union was 10·5, or four and a half times higher than in the remainder of the Union.

For convenience sake, the parish of West Thurrock may be divided into "Purfleet" and "West Thurrock." Purfleet consists mainly of workmen's cottages, 110 in all, chiefly of the cottage type. Near the cottages are the works already named. The garrison numbers approximately 215. The training-ship "Cornwall" contains about 266 persons. For reasons which will emerge later, it is advisable to keep separate the population of Purfleet from those of barracks and training-ship. The population of Purfleet hamlet was 479; that of the garrison and training-ship combined, 480. East of Purfleet lies the rest of the parish of West Thurrock, the populous part of which lies mainly on either side of the road from Purfleet to Grays. The houses on and near this road stop about a point half a mile from Purfleet, and therefore the hamlet of Purfleet is isolated or separated from West Thurrock by a strip of open country. The hospital ships are placed in the river about 700 yards distant from the nearest point of the parish. Reckoning the distance of Purfleet hamlet from the ships as a centre, it is just within the three-quarter-mile radius. Between this and the two-mile radius, the population of West Thurrock is very scattered and small in number. Just outside the two-mile radius lies the village of West Thurrock. Just within and on the border of the three-mile radius are the populous parts of the parishes of Aveley and Stifford, the population of which is 2,136 persons.

Between the third and fourth-mile radius are the town of Grays and the village of South Ockendon, which together have a population of 14,890 persons; and beyond the four-mile limit is the remainder of Orsett Union, with a population of 13,552 persons. The population of Tilbury Docks, which is of a closely aggregated character, numbers 4,877.

It is further necessary to state that the hamlet of Purfleet is artificially divided into two sections by a curve, equivalent to a right angle, of the London, Tilbury, and Southend Railway. One portion, therefore, lies to the west, and the other to the south of the railway.

Hospital Ships and Communication with the Essex Shore.—While

investigating the epidemic of 1893–95, Dr. Thresh came to the conclusion that some influence, out of the usual, was operating to cause the epidemic: in other words, that neither direct nor mediate infection, nor both combined, could account for the spread of cases. Further enquiry, however, elicited the fact that there had been a certain amount of intercommunication between the Essex shore and the ships. Thereupon, at the request of the Essex County Council, the Metropolitan Asylums Board altered the local arrangements at the ships so that all intercommunication would be prevented in future. Since that time, Dr. Thresh believes that none has taken place, save the probable surreptitious visit of a man to his sweetheart. In view of the above intercommunication, Dr. Thresh found that he could not well establish the view he entertained, that the spread of small-pox from the ships was due to aerial dissemination. But now that this intercourse had ceased, and in view of the isolated position of the ships, the study of the influence of aerial convection, if any, became much more simplified.

Outbreak of Epidemic.—The first case notified in the epidemic now under consideration occurred at the end of August, 1901, in the person of a man who worked as a signalman on the railway at Purfleet, at the point nearest to the hospital ships, but who resided at Grays. It was shown that this man was in the habit, periodically, of swimming in the Thames more or less near the ships, and that he had been doing this two or three weeks before he sickened. There was no history of his having been exposed to antecedent small-pox. The next two cases in Grays, notified also in September, were no doubt infected from this man. On September 13th, two notifications were received from West Thurrock. They were of the parents of this man; they had been visiting him at Grays when he was sickening from the disease. On the 15th, a third case was notified from the same village in the person of a man who worked at Purfleet Saw-mills. He had had, so far as could be discovered, no relations with the first case, nor, indeed, with any known antecedent case. On the 21st, a case was notified from Paper-Mill Cottages, West Purfleet. At the end of the month, three cases were notified from the parish of South Ockendon. They appear to have been infected from a man who had suffered from what at the time was believed to be "chicken-pox," which developed a fortnight after a visit to the signalman, when he was sickening. It is thus apparent, that while no trace of antecedent infection from any person or thing was discoverable in the cases of the signalman and saw-mill worker, all the other cases in different parishes had been infected from the

signalman. In the week ending October 12th, four cases were notified from Purfleet: one of a male who lived in West Purfleet, the other three, of a man aged 39, and two children, aged 11 and 5 respectively, who lived in Paper-Mill Cottages, where the case formerly reported on September 21st resided. These cottages consist of two rows of workmen's dwellings near the riverside works, the rows being some little distance from each other. No new cases were notified during the next two weeks. But in the week ending November 2nd, five cases were notified, three being in Purfleet, and two in Tilbury Docks. The cases in Purfleet were those of a boy aged 5, a girl aged 13, and a man aged 24. They all lived in the Paper-Mill Cottages. It is noteworthy that Tilbury Dock population was infected about the end of October. Indeed in the month of November, the district surrounding Tilbury Dock contributed eight cases locally to the Orsett epidemic. But it did more. As has already been noted, the influence of the Tilbury infection was felt very much further afield. On the 29th of November a man arrived in Glasgow from Tilbury, and sickened with smallpox the day after, the rash appearing two days later. Five more cases were recorded by the end of the week dated November 9th. There was one case in each of five different places in the Union, four of them occurring in neighbourhoods already infected. One case was in Aveley: this was a man who worked daily in a chalk quarry in Purfleet; another happened in Purfleet in the person of a man aged 39, who also lived in Paper-Mill Cottages, from which already 7 cases of smallpox had been removed. A third was in Tilbury Docks, the fourth lived in Stanford-le-Hope, and the fifth in the Grays Urban District.

Before proceeding further, it will be well to account, if possible, for the nine cases which occurred in Purfleet between September 21st and November 9th. It has been said already that no trace of antecedent infection could be discovered of the first case: the woman had not been away from Purfleet about the time she must have been infected. The three cases notified on October 10th had, in common, the opportunity of contracting infection from an un-notified case, presumably unrecognised, in a person who about a fortnight earlier had had all the signs of a mild attack. Her infection, however, could not be traced to antecedent infection, although in the middle of August a child of hers had had an illness believed to be chicken-pox. Of the five others, no facts could be ascertained which pointed clearly to relation with previous infection, although they lived in one of the two rows of cottages in which the case notified on September 21st lived. It must be observed, however, at this stage, that it is very significant that in these very rows of cottages there

should have been a missed case, as it makes it extremely difficult to get over the suspicion that, unknown to any of the individual persons, infection may have unwittingly taken place. The child of Mrs. C.—the missed case—was ill in August from chicken-pox, and spots appeared on its body. Buchanan, in his investigation, concluded "that neither the history nor the date of onset of Mrs. C.'s illness gave much reason to suspect she had been infected through this child, even though the latter had suffered from smallpox." The only observation that follows this is, that while it is quite true that immediate sequent infection may be apparently untenable from the dates, it is not beyond reasonable possibility that she was in the line of infection. This child's chicken-pox occurred in the "middle of August," the mother's attack of undoubted smallpox took place "about a fortnight earlier" than the 10th of October, which takes us back to the 26th or 28th September as the date of the mother's sickening. It is not unreasonable to urge that the case of E. B., living in the same rows of cottages, and whose case was notified on September 21st, was infected either from the mother, Mrs. C., during her period of sickening, or from her child during its convalescence. Neither is it beyond the bounds of reasonable possibility that in the case of the mother, Mrs. C., her infection was merely a deferred infection from infected clothing from her child. On this point it seems to me impossible to get rid of the fact that in two rows of cottages, relatively near one another, eight cases of smallpox are discovered within a period of forty-nine days in sequence to one another, and of the likelihood that unknown intercommunication between these eight persons, Mrs. C., the missed case, and her convalescent child, did take place. This does not even presume the absence of the most absolute good faith of all parties concerned.

In the week ending November 16th, no further cases were notified; but in the next week, November 23rd, 23 cases were notified, of which 9 were in Purfleet, 6 in West Thurrock, 1 in South Stifford, 3 in Tilbury Dock, 1 in Stanford-le-Hope, 1 in South Ockendon, and 2 in Grays. Buchanan in his report makes the significant remark that as the epidemic progressed in Purfleet, inquiries of a minute character as to local sources of infection were seldom made by the sanitary officers, but it was well ascertained that the dwellings in which the bulk of cases broke out were groups of workmen's houses, such as Paper-Mill Cottages and others. Ere long, almost any dwelling newly attacked by the disease had in its neighbourhood another dwelling in which the disease had recently been existent. It is a reasonable conclusion, therefore, that unwitting infection may have taken place among persons visiting houses in which infected

persons were sickening from the disease, or before disinfection had been completed. In few cases did it emerge that suffering persons had lived at home for several days before medical attendance was called; in one instance only was a man found at work while suffering from the disease. Chicken-pox did not prevail extensively in Purfleet during the epidemic, so far as was known. Notification of chicken-pox became compulsory, however, at the end of December, 1901, and from December, 1901, till June, 1902, 101 cases in all were notified in the Orsett Union. An analysis of that figure shows that only 1 case was notified from Purfleet in May, 1902, 16 from West Thurrock, 15 from Tilbury Dock, 11 from Stanford-le-Hope, 38 from Grays urban district, 2 only from the rural district of the Union, and the remainder from the other parishes. Among the 479 persons constituting the population of Purfleet, there were 47 cases of small-pox, showing an attack-rate of 100 per 1,000 of population. In the remainder of "West Thurrock," population 2,046, the number attacked was 70, the attack-rate being 33 per 1,000. The disease, therefore, was three times as prevalent in Purfleet as in West Thurrock.

In the eight months during which this epidemic lasted, the attack-rates for the different parishes and the remainder of the county were as follows:—

	Per 1000.	Ratio.
Grays Urban District	11·4	19
Orsett Rural "	14·4	24
Orsett Union	13·1	22
Remainder of County	0·6	1

These results, in terms of ratios, show that up till the end of March, 1902, small-pox was twenty-two times more prevalent in the Orsett Union than in the rest of the county, in the Orsett Rural District twenty-four times more prevalent, and in the Grays Urban District nineteen times more prevalent.

The attack-rates within different radii, reckoned from the hospital ship, put summarily, are as follow:—

Between seven hundred yards and one-and-three-quarter mile radius	110
" three-quarter-mile and four-mile radius in West Thurrock	33
In Aveley and Stifford	23
Between the three-mile and four-mile radius	19·5
Beyond the four-mile radius	6·6

Hospital Accommodation.—It may be said in a word that there was efficient hospital accommodation within the Union. The hospital is situated in the northern corner of the parish of Little Thurrock, is about one and

a half miles from Grays, and about the same distance from Orsett village. It stands in a plot of five and a half acres of ground, is comparatively remote from inhabited areas, and there are but few dwellings within a relatively short distance. There is one house within a quarter of a mile, three or four between that distance and half a mile, one group of houses within the mile, and the town of Grays lies within the mile and a half limit. The populations of the small groups of dwellings number forty.

Twenty beds were available in the hospital when small-pox broke out in Purfleet, but owing to rapid increase in numbers, temporary accommodation had soon to be put up. Counting the temporary accommodation, the number of available beds was 65, which number, however, during several occasions, was exceeded. The highest numbers ranged from 70 to 104 and 110. The hospital was overcrowded. Several workmen employed on the temporary buildings were attacked, but only one other person working or living near was infected, so far as was learned. Dr. Thresh says of the hospital, "that the distribution of small-pox in the parishes around does not appear to indicate that this hospital has had anything to do with the aerial dissemination of infection, but it is just possible that the influence, if any, is masked by the effect of other and more important factors."

Isolation of Cases.—The first cases in the epidemic were received into the hospital ships by arrangement. When on September 23rd the Orsett Fever Hospital was utilised for small-pox, all notified cases were isolated in it with the exception of 8 cases who were too ill to be removed. Patients were removed from their homes to the Orsett Hospital in ambulances. Complaints of the men in charge of these stopping at public-houses, and of children standing round the vehicles on these occasions, were made. One driver who had not been re-vaccinated was attacked by the disease. Dr. Thresh says that he had not met with a case which could be said to have contracted small-pox from an ambulance, or that the ambulance routes distributed infection.

Infected Bedding and Clothing.—At first, infected stuffs were collected and burned, because there was no disinfecting apparatus in the district. A "Thresh" disinfector was got later, but even then it was, at times, unable to cope with the material to be disinfected.

Disinfection of dwellings was effected by fumigation with sulphur. Complaints regarding house disinfection were made to the Local Government Board by the West Thurrock Parish Council, to the effect that it was not efficient.

Contacts.—The plan at first adopted was to attempt to confine in-doors the members of all families from which smallpox had been removed, on condition that each such family so treated should receive a weekly payment of £2 during the period of isolation. With one or two exceptions, the agreement seems to have been complied with. Contacts generally escaped infection: indeed, in one case only was a contact infected. Later in the epidemic, the sanitary officials changed the mode of dealing with contacts. They insisted that for two days at least the families of those attacked should remain at home, and for a time afterwards be kept under observation. Buchanan informs us, however, that as the epidemic progressed, this oversight was maintained "in a somewhat unequal and irregular fashion."

Condition of Population of Orsett Union with respect to Vaccination and Re-vaccination.—Generally, it may be said that the proportion of infants whose vaccination was not finally accounted for increased rapidly after the year 1891. During the six years, 1895–1900, more than a third, and in three of these years more than half, of the infants whose births were registered in the Union were not vaccinated at the end of 1900. The "conscientious objector" flourished in Orsett. Of the adult population, Buchanan was of opinion that it did not comprise any exceptional proportion of unvaccinated.

Age-incidence of those Attacked.—Of the 519 persons attacked, 398, or 76·6 per cent., were between the ages of 15 and 25; 108, or 20·8 per cent., below the age of 15; and 13, or 2·5 per cent., were at 65 years or over. The death-rate among unvaccinated children was 24·6 per cent., or excluding three cases of infants in whom vaccination was successful after exposure to smallpox, 22 per cent. No vaccinated child died.

Re-vaccination was largely accepted by the population because of the protection it was seen to give. By the end of March, 1902, 6,753 persons had been revaccinated by the public vaccinators alone. Conversion to re-vaccination seems to have been tardy, but fairly general.

Causes of Epidemic.—In this epidemic, failure to promptly isolate those attacked could not be said to be one of the causes of the outbreak. The occurrence, however, of mild, unrecognised cases in different centres undoubtedly contributed to spread the disease. In some of these cases the victims were found continuing their ordinary avocation. Moreover, there were in certain instances mild cases of undoubted smallpox in which there was no medical attendance, and there was the disastrous result of

mistaken diagnosis of smallpox for chicken-pox. All such cases, found as they all are in every epidemic, have no inconsiderable effect in spreading infection. Visitation of friends to patients in hospital was also a factor, on account of their refusal to be revaccinated. Thresh informs us of cases arising from this cause, due, he believes, to the absence of dread of smallpox by the poorer classes, which prompts them often to visit hospitals out of mere curiosity, or on the chance of seeing some one they know. During this epidemic too, while the temporary buildings were in course of erection, workmen contracted infection to the number of five, and in one case a workman infected his brother. Intercommunication between families at the time when individual members were incubating smallpox could not be ignored as helping to spread infection, and mediate infection by persons acting as passive vehicles of the contagium had to be borne in mind. In a wide district like this, which contains different groupings of population, and in which persons from one district are daily employed in another centre, spread of the disease by infected fellow-workmen had to be reckoned with. To a considerable extent, therefore, the range of spread is determined by factors such as these, and there is not a little evidence to prove that all of them operated in this way during the currency of this epidemic.

But it is alleged that, besides direct and mediate sources of infection, there appeared some other factor, not embraced among these, which originated and spread the outbreak. Dr. Thresh has no hesitation in declaring that factor to be aerial influence from the smallpox hospital ships in Long Reach. Buchanan, after investigation of the facts, arrived at the conclusion that "as regards the influence of the hospital ships upon prevalence of smallpox in Purfleet during this epidemic, we have to choose between aerial convection or nothing: there is here no question of infection, direct or mediate, through human intercourse or traffic. As to the latter alternative, I would say at once that if the presence of the smallpox ships in Long Reach had no concern with the Purfleet epidemic, then, while making every allowance for opportunities of local spread of the disease, I am nevertheless quite unable to suggest any reason for the extraordinarily heavy and long-sustained prevalence of smallpox there. If, on the other hand, the ships did exert influence on the epidemic, infective particles being from time to time, under favouring meteorological conditions, conveyed to the area of Purfleet and there enforcing smallpox already prevalent, or setting smallpox going anew, then not only is the Purfleet experience intelligible, but the hypothesis invoked to explain it is one that has been shown to be necessary, in our present knowledge, if the

characteristic peculiarities in the distribution of small-pox in the neighbourhood of small-pox hospitals are to receive anything approaching a sufficient explanation." Thresh, however, seems to incline to the belief that it is necessary to invoke the aerial theory of convection not merely to cover the Purfleet incidence, but a much larger area than seems to be embraced within Buchanan's consideration. He says (Op. cit., p. 110) "the extent of the area around a small-pox hospital which may be affected directly and indirectly by the hospital is apparently much larger than has hitherto been supposed. In the case we have been considering, the influence is probably being felt at a distance of fully three miles, and the presence of a belt of water half a mile in width is powerless to arrest the spread of the contagion." It will be seen that in the foregoing statement, all the old question has been mixed. It will be observed, that he includes under hospital influence, *direct and indirect effects*. It appears to me, in discussing the value of the doctrine of aerial convection with regard to any given set of events, that direct and indirect effects must be clearly dissociated if we are ever to hope to be able to appraise the true worth of the doctrine. Even in this epidemic Buchanan will not go the length of Thresh respecting the range of action of aerial influence of the ships upon the Orsett Union. He frankly acknowledges, what must be obvious to every one who makes an intimate study of the facts of small-pox epidemics in which the theory of aerial influence has been invoked to account for the facts, that the doctrine of infection disseminated by the air from a hospital must be based upon a balance of probabilities, as the doctrine cannot be proved by direct experiment. Says Buchanan very truly, "from the nature of the case, proof, in a strict sense of the word, is unattainable. For proof to be afforded it would be necessary first to ask whether during the epidemic there was evidence that the ships occasioned an intensity of infection in their neighbourhood, graduated from centre to periphery, and comparable to that observed within a mile of other hospitals on other occasions. This cannot be answered: the ships have the uninhabited Dartford marshes to the south of them; there are, practically speaking, no dwellings within a mile save those of Purfleet." But he believes, as tending to proof of this intensity, that the experience of the men employed in the erection of the temporary buildings on the Dartford marshes close beside, but separated from, the administrative buildings by a close fence, who were attacked by small-pox to the number of sixty, cannot be overlooked. Buchanan does not go the length of affirming that all of these men were attacked solely by aerial influence, because some of them were found to be suffering from small-pox at the time they were actually

being employed. In the same direction he cites further the experience of crews of ships who pass these hospital ships in their passage up and down the Thames, or are compelled by reason of fogs in the river to anchor more or less near them for variably short periods of time; and in particular, the case of the s.s. "Stuma," under the latter category, in which two cases of small-pox occurred within fourteen days after that ship had been moored alongside the hospital ships. Indeed, Buchanan cannot follow Thresh with respect to the extent of range of influence of the hospital ships. He points out very aptly, that "an important element of uncertainty has to be reckoned with"; for although the gradational incidence does not follow lines of human intercourse between the hospital ships and the areas attacked, it does follow—and, it appears to me, very markedly follows—lines of human intercourse and traffic to and from Purfleet in which the epidemic originally broke out, and in which it prevailed so extensively and so sustainedly. From a consideration, therefore, of all the facts, it is not surprising to find Buchanan coming to the following finding, viz.:—"I am unable to consider aerial convection otherwise than a possible factor in the spread of small-pox in localities considerably more than a mile away from the hospital ships: one that may or may not have operated, and which, if it did operate, may or may not have materially conduced to spread and maintenance of small-pox in the areas in question. . . . The facts available do not suffice to indicate whether prevalence of small-pox in inhabited areas distant from two to five miles or further from the hospital ships has been realised in material degree, or at all, to infection conveyed aerially from the ships to those areas."

Relation of Number of Cases of Small-pox in Hospital Ships to Outbreak.—It will be remembered that the first case of the epidemic was notified in the week ending August 31st, in the person of the Purfleet signalman. During the month of August, while 14 cases were already on the ships, 58 more cases were admitted, and between November, 1901, and June, 1902, the average daily number on the ships was 164, the minimum and maximum daily numbers being 97 and 271 respectively. It will be thus apparent that the Purfleet signalman was attacked when there was relatively a small number of patients on the ships. Whether or not the increasing numbers on the ships contributed to the spread of the epidemic, in view of the local agencies at work in the way of direct and mediate infection, appears to me to be a matter incapable of proof. But the aerial doctrine may be tested in connection with the hospital in connection with the Union itself. As has been observed, the number of beds, counting

those added in temporary buildings, was 65 after January; but after that date it was always more or less overcrowded. It is difficult, except by extreme stress of circumstances, to justify the putting of 104 or 110 patients into a hospital meant to hold only 65; but it was done. In spite of this overcrowding, however, we have the testimony of Thresh that it did not seem to have anything to do with the dissemination of the disease, or that if it did exert any influence, that was masked by other and more important factors. It is quite true that within three-quarters of a mile of it there were only forty resident persons: but even here, one asks, why should aerial influence not prevail as it is alleged to have done from the hospital ships.

Meteorological Conditions Relative to Ship Influence.—Thresh thinks that certain meteorological conditions have an important bearing upon the outbreak and spread of the disease in this epidemic. During the eight months in which it existed, the prevailing winds were from south-west and from west-south-west: thus the winds blew from the ships in the direction of Purfleet, and especially over South Purfleet. In this way he accounts for the relatively high prevalence in South Purfleet and the relatively low prevalence in West Purfleet. Buchanan thinks it worth noting "that during the beginnings of the epidemic in Purfleet—in September, October, and the early part of November, when the cases to which I have alluded (the nine cases in Purfleet) were occurring—the weather, as a whole, was characterised by an abundance of calm, almost windless, days and nights, many of them accompanied by fog." He adds: "It is easy for anyone acquainted with the hospital ships and their method of ventilation to realise the large volume of warm air derived from the wards, accompanied by suspended particulate matter, which must rise steadily upwards from the ships on days of this kind, and to understand that particulate matter thus conveyed by the air may, without great dispersion, be wafted by gentle air currents, ultimately to settle, now, for example, on Purfleet, now on Dartford marshes, at one time towards Erith, or at another on the surface of the river. A moderate or strong wind on the other hand might be expected to cause rapid dispersion and removal of particulate matter from the ships." In the Table of Meteorological Observations taken at the Royal Observatory, Greenwich, for the four months September to December inclusive, it is noteworthy to observe that during the first eight days of September, during both night and day, except on the 8th of September, when apparently for a short time only the wind was S.S.W., the wind was mainly easterly, that is to say, it was either N.E., E.N.E., N.N.E., or

E.S.E. From the 9th to the 15th of September inclusive, it was mainly from the N., or northerly directions, and only on the 9th and part of the 10th and 11th of September was it S.W., or W.S.W. For the first 14 days of September, therefore, the wind was not a favouring wind to support the aerial convection theory. If, therefore, at the beginning of the epidemic the hospital ships exercised any influence on the outbreak of the disease in Purfleet, the wind was not a favouring factor. It seems to me, that this is of the utmost importance, when we consider the fact that the aerial influence of the hospital ships was supposed to be exercised in the causation of these nine cases. Upon this wind movement, too, Thresh bases his reason to account for the relatively less attack of West Purfleet. Buchanan states that the relative freedom of attack was to be partly accounted for by the fact that several of the West Purfleet population had already had small-pox, several had been re-vaccinated previously, and many of the infants had been primarily vaccinated. At the same time, it is of consequence to note, as traversing the view entertained by Thresh regarding the immunity being due to wind conditions, that one of the very first cases to be attacked in the outbreak, indeed, the second of the nine cases upon which so much importance is placed as indications of aerial influence, was a man, aged 21, who lived in Dell Cottages, West Purfleet: this being one of the cases in which no exposure to antecedent infection was known. Some importance has been attached by Thresh, as proof of the aerial influence of the hospital ships in the causation of former outbreaks in the Orsett Union, to the gradational incidence of attack of areas in graduated distances from the ships as a centre. It appears to me that no evidence, except in a very general way, is of any value prior to the outbreak of 1895, owing to the known existence of direct communication from the ships to the Essex shore; in other words, that under circumstances of possible direct infection, no discrimination can be made between infection which might have been conveyed directly from the ship, and that from aerial dissemination, since the one could not easily, if at all, be distinguished from the other. Therefore such evidence as has been adduced from the experience of former epidemics to prove aerial infection from the ships must be estimated only for what it is worth, and that, in my opinion, is nothing as valid evidence. It is only when we start upon our inquiry with the certain knowledge—if that even now is possible—that intercommunication between the ships and the Essex shore has ceased, that we can pretend to try to unravel this somewhat difficult problem. Therefore, it is only by sifting the facts of the present epidemic very carefully, and by criticising their value, that we shall be able to arrive at a reasonable conclusion one way

or another respecting the likely operation of aerial convection of infection from the ships.

The Influence of the Hospital Ships with relation to Epidemic.—In pursuing this line of argument, it is essential that certain facts already mentioned must be recapitulated. We start from the first case, that of J. P., the Purfleet signalman. His case was notified in the last week of August. He lived in Grays town. He swam occasionally in the Thames near the hospital ships. The next two cases in sequence, as known to the sanitary authorities at the time, were this man's parents, who lived in West Thurrock, but who had visited their son while he was incubating the disease. Their cases were notified on September 13th. The third case had not been in relation with J. P., nor, so far as known, with any antecedent source of infection. He worked in Purfleet saw-mills. His case was notified on September 15th. Then on September 21st came the case of the woman who lived in Paper Mill Cottages, in South Purfleet, regarding the source of whose infection nothing was clearly found out. Then on October 6th there is the case of J. G., a man of 21, who lived in Dell Cottages, in West Purfleet, the source of whose infection could not be discovered; then on October 10th three more cases are reported from Paper Mill Cottages, followed by another case from the same cottages on the 28th, another from the same place on the 29th, another on the 30th, and on November 9th still another from these same Paper Mill Cottages. On this date also is notified a case from Aveley, in the person of a man who lived there but who worked in a chalk quarry in Purfleet. It was probably when inquiry was being made respecting the sources of infection of the Paper Mill Cottages cases that discovery is made of the "missed" case, and of the history of "chicken-pox," dating back to the middle of August. Three of the cottage cases had opportunity of contracting infection from this woman. But of the other five cases in these cottages, "neither Dr. Corbet nor Dr. Dunlop who attended them had in any instance ascertained facts clearly pointing to an antecedent case or cases as cause of infection, nor could I (Buchanan) trace any relationship with such cases." Besides these cases named, three other cases were notified from another part of the district at the end of September. They related to persons who appear to have had contracted infection from a man who had had what was taken to be "chicken-pox" fourteen days after a visit to the Purfleet signalman, when he was sickening from small-pox.

The sum of the foregoing is this: from the week ending August 31st till November 9th inclusive, we have to deal with sixteen cases of small-

pox, in eight of which no history of antecedent infection is known, and in eight of which previous communication with antecedent infection is proved. In the former eight are included (1) the case of the Purfleet signalman, (2) the first case (Sept. 21st) in Paper Mill Cottages, (3) the man in Dell Cottages, West Purfleet (Oct. 6th), (4) the case of the man (Sept. 15th) in West Thurrock, and (5) the other four cases in Paper Mill Cottages, notified on Oct. 28th, 29th, 30th, and Nov. 9th. Of the five cases in the Paper Mill Cottages, there must be considered in reference thereto the "missed" case of Mrs. C. and her child's "chicken-pox." It appears to me to be impossible to positively affirm, one way or the other, whether these five persons had, or did not have, any relationship, accidental or otherwise, with Mrs. C. or her child, seeing that they all lived within close distance of one another as a small community. It is not unreasonable to venture the opinion that chances of relationship were not unlikely, although no details one way or the other are given in Buchanan's report. The weight of the one opinion or of the other, under the circumstances, would be about equal. If these cases could be eliminated on the ground of known relationship with the cases of this woman and her child, there would only remain the case of the signalman and the West Thurrock case as instances of unknown antecedent infection. But even counting the Paper Mill Cottage cases, there are only eight cases upon which to bas in this epidemic at its commencement the possibility of aerial influence of the hospital ships.

The other important point which emerges is that, by the beginning of November, we have four or more different foci of infection in different parts of the Orsett Union for the spread of small-pox. After that date, and taking into consideration the fact that small-pox is mistaken early in the epidemic for chicken-pox, and that infected persons are found at their work, it does not appear to me necessary to account further for the progress of the epidemic in a susceptible population, except to add that persons proceeded daily from peripheral parts of the Union into infected centres, to and from their work, and who at the time had small-pox on their bodies. In short, we have eight cases at the very most, and even then some, of whose infection reasonable explanation may be made without recourse to any aerial influence, as the indication in the population of the Orsett Union at the beginning of the epidemic, of the aerial spread of infection from the hospital ships. In any case, when the details of the spread of the epidemic are considered, it is quite clear that traffic to and from other parts of the Union must be looked upon as largely to blame for the extent of range and persistence of the epidemic. Purfleet is not like

many other places of similar size and population, self-contained: on the other hand, it is the centre to which are attracted for daily work many persons from more sparsely-populated parts of the Orsett Union. Considerable intercourse took place also between Purfleet and Grays. Several persons belonging to Grays worked in the Purfleet works; for example, five out of the twenty-five cases notified in December were employed in one or other of the Purfleet works, four of the January cases, and single cases in each of the months of March and April. Persons from Grays visiting Purfleet were known to have been passive carriers of small-pox to persons in their own town. The same generally was true of West Thurrock. Six or seven persons employed in Purfleet from that village were attacked by the disease. In South Ockendon, too, the same general observation holds good. Between the middle of October and the end of January, no cases were known in that village, but about the latter time an outbreak involving twenty-seven persons took place, the first case of the series being a man who worked in Purfleet. In Averley, a case was notified as early as November 9th, of a man who worked in Purfleet. But the outbreak of twenty-two cases in fourteen houses in that place between December 10th and the beginning of February, was ascertained to be chiefly, if not entirely, due to undetected small-pox in a family in the place, in which a mother and a child suffering from mild small-pox did not have medical advice, and remained at home for two weeks or more before the exact nature of their illness was discovered.

In view, therefore, of the very limited number of cases involved, eight at the outside, at the commencement of the epidemic, of the doubtful source of infection of five or some of these, of the generally easterly and northerly wind movement during the first half of September, of the incidence of the cases at the outset, and of the susceptible condition of the infantile population and adult population, it does not appear to me to be well established that aerial influence need be invoked to account for the outbreak or its continuance in the Orsett Union.

Immunity of Garrison and Training Ship.—Little need be said respecting the immunity to small-pox exhibited by these communities. No small-pox occurred among them. They were protected populations, owing to the practice of re-vaccination. At the time of the outbreak some of the garrison had not been re-vaccinated, but in the interval of performing that operation they were prevented from entering infected neighbourhoods. Two cases of small-pox occurred, however, in the neighbourhood of the barracks.

Before, in any given epidemic, the conclusion is arrived at that aerial

convection or dissemination from a small-pox hospital has been any factor, or an important factor in the origin and spread of the disease in a neighbouring population, there are certain circumstances which are bound to have the most careful consideration. One of the first of these is: whether the inmates of any institution contiguous to the small-pox hospital have suffered from the disease in a measure corresponding to that found in the general outside population.

Fortunately, this question may be answered now from a variety of experiences which have occurred during different epidemics in different places. In answering it, however, due enquiry must be made respecting the protected or unprotected condition of the inmates of the particular institution in question by reason of former small-pox attack, or by vaccination and re-vaccination, since, obviously, this is bound to have the most important bearing upon the results likely to be found, and upon the conclusions deduced therefrom. To some extent, also, must the age-incidence of the inmates be considered, because owing to the relatively much diminished susceptibility of those aged fifty and upwards to attack, even without protection by vaccination, the attack-rates of different institutions are likely to vary in amount.

It has been shown that the hospital provision and means of isolation adopted in Germany have been entirely determined by the protected condition of its population by compulsory vaccination and re-vaccination. In our own country, moreover, occasional examples of like protected communities are met with in institutional populations. The history and experience, for example, of the Purfleet garrison, and of the inhabitants of the training ship, during the Orsett Union epidemic, illustrate on a small scale what the German experience does on the large scale.

Keeping, therefore, these points in view, our observations may be centred in the answers which the circumstances of institutional populations situated relatively near small-pox hospitals permit us to give. The two relevant questions, therefore, in this connection appear to me to be these: (1) Whether a relatively like attack-rate or relative immunity to attack has been found to prevail in institutional populations in different epidemics; and (2) What evidence is thus afforded, one way or the other, in favour of or against the view of aerial convection or dissemination.

The following is pertinent to the consideration of the first query. The comparatively small attack-rate found in the workhouse populations in the Sheffield and Ecclesall Bierlow Unions during the Sheffield outbreak, and of the workhouse and brewery populations during that of Warrington, show at least that in some instances small populations may

exist alongside concentrated acute small-pox without incidence of infection other than that due to direct or mediate sources. In these instances, certainly, where presumptive risks of aerial transmission of the disease would be present if aerial convection prevailed, no such evidence was forthcoming after inquiry. In the Sheffield unions, where small-pox cases were being treated in relatively large numbers in pavilions within the workhouse curtilages, and in the Warrington epidemic, where the workhouse was only separated from the small-pox hospital grounds by a wall, there was no evidence discoverable by Dr. Barry in the former, or by Dr. Savill in the latter, that aerial transmission had anything to do with the causation of the cases which did occur within these contiguous buildings. Dr. Barry, indeed, declared that direct and mediate sources of infection from the hospital accounted for all the cases in the Sheffield institutions, and Dr. Savill was able to track the direct or mediate sources in the cases which developed within the Warrington institutions.

The Commission on Small-pox Hospitals, moreover, had not a little evidence presented to it by different witnesses with regard to the relative immunity of like institutional populations elsewhere. Dr. Dudfield, for example, in his evidence stated that Homerton Hospital, which is situated from ninety to a hundred feet from the City of London Infirmary, did not appear to have had at any time any inimical influence in this direction, and that no cases of small-pox had occurred in the latter institution from the treatment of acute small-pox cases in the former. The Commissioners themselves seem to have been struck by this fact, as is shown in the following passage, which I quote from their report. Referring to the above case, they said that "the workhouse had scarcely any cases in the epidemics of 1871—77, when the disease was extremely prevalent in the surrounding streets, although at that time the inmates were not protected by re-vaccination. The same may be said of the Hackney Union Workhouse and Infirmary, which are about a quarter of a mile from the Homerton Small-pox Hospital."

In the Fulham District, there were four similar institutions within half a mile of Fulham Hospital, but curiously enough, Power says nothing regarding their fate in his report. From the evidence laid before the above Commission, we are able to appraise the extent of attack on the inmates of the City of London Infirmary, and to compare it with the extent of attack on the inhabitants in the adjoining streets. We learn that during the eleven years ending 1881, 17 cases of small-pox had occurred in its wards. Of these, Dr. Aveling stated in evidence, that 12, and possibly 15, had contracted the disease within the institution. But even the largest of the figures given, in view of the fact that the inmates

numbered 450, does not betoken aerial transmission of the disease. Further analysis of the 17 cases shows that the incidence in number of cases in each year during the eleven years was not unlikely determined by the policy of the hospital with regard to the practice of re-vaccination. It would appear that between 1871–76 re-vaccination was not carried out systematically on the inmates, that in 1876 it was commenced, and that between 1877 and 1881, both inclusive, it was systematically practised. It is not surprising, therefore, to find that 13 of the 17 cases occurred during the first period, and the remaining 4 cases during the latter period. The evidence also shows that during the ten years, 1871–80, the attack-rate in the streets around the hospital within the ¼-mile radius varied from 4 to 25 per cent., the average being 9 per cent., whereas in the workhouse it was less than 4 per cent., calculated over the ten years. These figures illustrate in some measure the effect of no special provision of re-vaccination and of its systematised operation upon the incidence of the attack-rate within one institution. Again, the case of Hackney Workhouse and Infirmary is instructive. It was about a quarter of a mile from Homerton Hospital. During the eleven years, 1870–81, it had an average yearly population of 643 persons, the number of small-pox cases which occurred within it being 20. Here it was the habit to vaccinate early all infants born in the building, and to re-vaccinate such of the other inmates as chose to have it done.

In this connection, the cases mentioned in Thorne's Report must also be noted. These were relative to the small-pox hospitals of Leeds and Nottingham. In the Leeds case, the hospital contained 118 small-pox patients, and was situated from 36 to 200 feet only from neighbouring dwelling-houses. Although the authorities would have been pleased to get evidence of harm from the hospital to the houses, none could be shown on inquiry. In Nottingham, the small-pox patients occupied a new wing of the workhouse buildings which had been built immediately continuous with these buildings, and which was bounded on one side by a narrow street. Although the windows of the small-pox wards in this case were only 44 feet from the houses in the street, no evidence was obtainable to the effect that small-pox had been spread to the neighbouring houses. During the Glasgow epidemic of 1900–02, in an institution immediately contiguous to the curtilage of the small-pox hospital, one case only of small-pox occurred, even although for most of the time the small-pox hospital was crowded. Even in this case it was not possible to exclude the possibility of in-brought infection from outside. So far as I am aware, this is the only occasion during the different epidemics in Glasgow, during which the present small-pox hospital has been in use for the treatment of

cases, in which any small-pox appeared in the institution in question, notwithstanding the fact that the hospital was on all these occasions always more or less full of patients.

It may be said, therefore, that experience regarding institutional populations in the near neighbourhood of small-pox hospitals demonstrates that they have enjoyed lower attack-rates than general outside populations, and to an extent wholly inconsistent with the view that aerial transmission or dissemination from the hospital of the contagium prevailed. Moreover, it must further be said, especially of the Sheffield, Warrington, and other epidemics, that when small-pox cases did arise in such institutions, the source of infection by direct and mediate means could be traced.

Many interesting speculations arise in the discussion of the reasons for such relative immunity. It may be said that in respect that the inhabitants of such places have fewer opportunities of public sources of infection by reason of their confinement within the institutions, it naturally follows that a lower attack-rate ought to be anticipated. To this must be added the effect of age incidence of the inmates. Whether or not these reasons are sufficient to account for the relative immunity which they have been proved to enjoy at times when around the institutions the disease prevailed extensively, is an open question, but doubtless they operate to some extent.

The only answer which can be given to the second query before propounded, in the light of the evidence, is that the experiences of different institutions in different places during different epidemics is distinctly against the theory of aerial transmission; indeed, from the very fact that in the cases given, which form all those within recent epidemics whereby the doctrine of aerial convection might be tested, direct or mediate sources of infection were traceable, forms a body of strong positive evidence that aerial dissemination from the small-pox centres did not at all operate. Further, in view of the fact that these institutions with respect to vaccination and revaccination were reasonably comparable with the general outside populations, and yet had a relatively lower attack-rate, affords still stronger proof of the absence of aerial transmission. What proof must be considered as reasonably sufficient to prove the operation of aerial transmission or dissemination as the cause of origin or spread, or both, of any given epidemic from any given small-pox hospital? This question would deserve comparatively little attention if it were merely a subject of academic discussion. But it is much more than this: its consequences are very important and far-reaching. If aerial convection be a fact, obviously it must have a serious bearing upon the position which small-pox hospitals ought to occupy relative to contiguous populations. McVail (Brit. Med. Jour., Vol. II., 1902, p. 32) puts the matter so

pithily that I quote what he says: "Every epidemic of small-pox shows more and more clearly the dangers attached to such hospitals. Where they are in use on any large scale near any considerable population, they are very likely, if not quite certain, to have the effect of spreading small-pox in the surrounding neighbourhood. The facts give very strong evidence that the spread is both aerial and by contact, and indeed, it seems to defy every preventive measure. If these conclusions are sound, they raise some very serious questions. Where are sufficiently isolated sites for small-pox hospitals to be found? What right has a city community to determine that the residents in any particular locality within its bounds, or in the country near it, shall be exposed to the risk?" The Commission on Small-pox Hospitals have had their views reflected in the regulations laid down by the English Local Government Board for the sites of new small-pox hospitals, and these regulations, moreover, to some extent, also carry belief in the aerial theory of dissemination, as laid down in Power's Report, to certain defined distances from a hospital, depending upon the existence of institutions and numbers of populations within these distances. But what shall be said of the views of later writers, who aver that the influence of a small-pox hospital may be transmitted, and may operate at a distance of three miles therefrom? It is only reasonable to expect that before such an opinion is deliberately promulgated there should be the clearest unequivocal evidence of the existence of aerial transmission and operation, because of the momentous issues which are thereby involved.

This brings me then to the kind and character of the evidence which ought to be deemed as relevant to prove the existence and operation of aerial influence.

Savill, in his report of the Warrington epidemic, has given some attention to this subject. He lays down the following four conditions which, in his opinion, are necessary in any given instance to prove aerial convection, viz.:—(1) That the immediate and mediate methods of infection are neither of them in operation in any given case or cases which form the basis of observation: (2) That the proportion of infected houses or persons (whose infection is not accounted for by mediate or direct means) varies with the distance from the supposed centre: (3) That the proportion of infected houses (where the infection is unaccounted for by direct or mediate means) in a given district round the supposed centre varies with the direction and the strength of the winds: and (4) That the proportion of persons so attacked varies with the number of cases collected in the supposed centre, and as some say, with the stage of the disease which the cases have reached: in other words, the period of a "rising epidemic."

In discussing these conditions, it is necessary to ask whether or not it is possible to realise them in any given epidemic. With regard to the first, all that needs be said is, that the usual reason in recent epidemics for invoking the aerial theory is that in a certain number of cases of small-pox, within a certain distance of the small-pox centre, no direct or mediate source of infection is discoverable. In the Fulham epidemic, for example, there were within the special area twenty-three such cases, and in the Orsett Union epidemic at the outset six such cases. To account for such, therefore, it seemed necessary to invoke some source out of the usual course, and it was believed only aerial dissemination from the small-pox hospital fitted the facts. But the question must be fairly put and answered: in any epidemic of small-pox is it always possible, for a variety of reasons, to track the source of infection of all cases, even indeed of those which occur in areas considerably beyond the supposed range of aerial influence? I fear that the only answer which can be offered will be in the negative. Much of the information regarding sources of infection of groups of cases is often obtained *post facto*, and sometimes long after they have done all the mischief they could in spreading the diseases: and there can be no doubt that some mild cases during the currency of an epidemic go undetected from first to last. Owing, in short, to the existence of undetected, mild, ambulant cases of small-pox, or of so-called, non-medically treated cases of "chicken-pox," in the pre-epidemic stage of an outbreak, susceptible persons are infected from these under circumstances to them unknown, and consequently they are unable to account for the origin of their attack. Such conditions, indeed, prevail during the whole currency of an epidemic, but there is a better chance of their detection when the public mind is on the alert, while the epidemic is actively in progress, than at the commencement when the outbreak is not anticipated. Ample illustrations of this are found in all epidemics. Here then, at the very outset, are we met with an insuperable difficulty, that is, to say whether or not any given case or cases have been infected directly or indirectly; in other words, it cannot be averred of any given case or cases that direct or indirect infection did not take place merely because the source of the infection cannot be traced, even pre-supposing the very highest detective attributes in the inquirer.

Savill's second proposition, however, provides that another test should be applied to such cases. Does the proportion of infected houses or persons vary with the distance from the supposed centre? It will be noted that the statistical test here proposed differs radically from that at present adopted. The method adopted by Power, and followed by most observers since, to demonstrate the aerial influence of a small-pox hospital, is to con-

struct rings or circles within varying distances of the hospital as a centre, and to calculate per 1,000 persons populating said circles, or per 100 or per 1,000 houses within these areas, the ratios of persons attacked or houses invaded by the disease. It will be observed that all the cases attacked or houses invaded are slumped together, irrespective of whether they have been infected directly or indirectly, and the gross number is calculated into the numbers of population or houses respectively. Let it be borne in mind that this mode of computation is intended to indicate, not simply the incidence of the disease in these different areas, but the transmission aerially of the disease from the hospital. It goes without saying that this mode of computation involves grave fallacies. Starting out to discover small-pox incidence from aerial influence from a small-pox centre, the method includes *all* infected cases, no matter whether imported or not, and no matter whether directly or indirectly infected, to prove that this incidence is due to aerial transmission; in other words, the unaccounted-for cases, upon which the aerial theory is founded, and the accounted-for cases are added together to show that the influence which has determined the origin of the former class must proceed from the hospital. It is not beyond the bounds of possibility to find infection introduced into a district not far from a small-pox hospital, and to see the disease spread in that district. That, in fact, was the history of the outbreak in Glasgow in 1900—02. When the incidence of attack-rate in different zones comes to be calculated, one could expect nothing else than to find exceptional prevalence of the disease in the zones nearest to the hospital, and greater in amount than in zones further removed. Reckoned on the methods now used, such figures would be held to be proof of aerial influence from the hospital, whereas they do nothing more than indicate the locality of origin and spread of the outbreak. It is difficult in a few lines to show how the present statistical expression of incidence of small-pox may lead to grave fallacy without full regard being paid to the intimate facts of the beginning and course of the epidemic; it is enough to say that in any attempt to prove aerial convection from a hospital, it is statistically improper to include those cases whose direct and indirect sources of infection have been found with those whose source of infection is not discoverable. It is necessary to note that I am not now discussing the question of the general influence of a small-pox hospital, but hospital aerial influence as a separate entity or factor in the spread of the disease in neighbouring populations. It seems to me to be clearly established that hospitals placed in close proximity to such populations are calculated to spread small-pox by direct and mediate means; but my contention is that evidence to prove aerial convection therefrom is not forthcoming. The continuous traffic of infected persons and things to the

hospital, the possible "leakages" therefrom, and the other well-known possible means of communication of those within the infected area with those without, fully account for this inimical effect. But when the aerial theory is invoked, it is necessary to justify by evidence the opinion which is expressed. And in this direction, having eliminated by searching, patient, and persevering enquiry the possibility of direct or mediate infection (if that be humanly possible), it is only relevant to bring into the calculation such cases whose origin it is impossible to account for. Such a method of reckoning aerial hospital influence would at least be on right lines, however much, even then, it would be subject to criticism owing to the fallibility of human discovery.

Another mode of statistical expression to test aerial influence is by quadrants constructed from the hospital as a centre and worked into the same distances and on the same bases as in the circles. The chief object of this method seems to have been to test the doctrine of aerial influence by the incidence of the disease in the different quadrants in relation to the direction of the winds prevailing at the time. Power believed that three meteorological factors appeared to aid in the operation of aerial convection, viz.: (*a*) a still, foggy atmosphere; (*b*) low temperature; and (*c*) absence of ozone. Other observers think that the contagium is likely to be borne in the direction of the prevailing winds. From a consideration of the meteorological conditions found to prevail in different epidemics in which aerial influence was believed to exert its effect, it appears to me that the foregoing concurrent conditions are by no means uniformly present. In the Warrington epidemic, Savill noted by this system of quadrants that the incidence of the disease in the neighbourhoods of the hospitals was less severe in the very quadrants which ought to have been infected by wind-borne contagium from the hospitals; and in the Orsett Union epidemic, the meteorological tables appended to Buchanan's report show that for the first fourteen days of September—when the first cases occurred—the direction of the wind was not favourable for carrying the contagium from the hospital ships to Purfleet village. In the Leicester epidemic of 1892—93, relative to the supposed aerial influence of the hospital on the suburban district of Newfoundpool during the month of June, Dr. Priestley informs us (*The Lancet*, Aug. 6th, 1894) that the temperature varied from 45 to 70 degrees—generally, a high mean temperature—the barometric pressure was high, there were nineteen days with blue sky and nine days with cloudy skies, and the wind blew from the hospital to the houses invaded. Here, then, in different epidemics, we have such diverse conditions as still, foggy weather and blue skies, and keen frost and a high mean temperature, in which aerial convection

was supposed to prevail. Such facts as these merely go to show that no uniform concurrent meteorological conditions are found to prevail while aerial dissemination is believed to have been active. Assuming for the moment the truth of this doctrine of aerial convection, Savill's figures for the Warrington hospitals show that the incidence of the disease was not greatest in the path of the prevailing winds, and that with regard to one of the hospitals, the incidence was exactly the converse of what might have been expected.

It is not necessary to discuss in detail the fourth condition which is set down by Savill. Probably it is enough to say that the general consensus of opinion and accumulated proof tend in the direction of affirming the truth of the view that the contagia of air-borne infectious diseases generally gain intensity by accumulation or concentration of cases within hospital wards, and that that is true of small-pox, keeping its special features in view, like the others. Further, it may be said that quite apart from hospital influence, an outbreak of small-pox in any community can only occur by the introduction of pre-existing contagium, and can only spread by the susceptibility to attack of those who are exposed to it: hence the range of operation of any given outbreak of small-pox is determined by the immediate area into which the contagium is conveyed, and by the susceptibility of those who come within the sphere of its action. Were it always possible to isolate all who are attacked first, and all those who have been exposed to the contagium, all outbreaks would be stopped quickly, but it is entirely owing to the difficulties experienced in effecting this that the disease continues to spread. The susceptibility of a population to small-pox, therefore, during a rising epidemic means little more than that persons constituting part of that population offer a suitable soil for the organism.

The conclusion at which I have arrived from this critical study of small-pox epidemics with regard to the doctrine of aerial convection, is that the doctrine has not been proved, that in some of the epidemics the conclusion as to aerial evidence is blighted by the want of distinction between the hospital as a direct and indirect source of infection of those resident outside its walls, and that in others the doctrine has been suggested from the flimsiest evidence. To my mind, as indicative of proof against the doctrine, there are the different histories and experiences of institutional populations placed within the range of aerial influence, if it existed, which cumulatively compel me to say that no such aerial dissemination seemed to have existed.

CONGRESS AT GLASGOW.

SECTION II.—ENGINEERING AND ARCHITECTURE.

ADDRESS

By Prof. HENRY ROBINSON, M.Inst.C.E.
PRESIDENT OF THE SECTION.
(FELLOW.)

WHEN the Council of The Sanitary Institute invited me to preside over this Section, I felt, whilst appreciating the compliment paid me, that I should experience a difficulty in preparing my address, as the subjects which interest all who are engaged in advancing sanitary work in engineering and architecture cover so wide an area. I decided, therefore, to confine myself to reference to those with which I have had to deal in my own professional life, as they embrace matters of great interest and importance, and, at this time, justify special attention being given to them.

Those who have to advise in regard to works which affect the health of the community have a responsibility which should never be lost sight of. If their functions are faithfully and skilfully discharged, there will result an improvement in the hygienic conditions of our centres of population, with the consequent increase of health and happiness in many homes where, if these functions were not well performed, there would either be loss of life, or of that energy which makes existence useful and enjoyable.

In advising as to the expenditure of public money on sewage outfalls there is abundant data now to determine the right system for each place. I am quite confident from my experience that the conditions vary sufficiently to require intelligent and impartial consideration to be given as to which of the several systems, or combination of them, best meets each case, as it is too often the practice to apply an arrangement of works, or a system, to an outfall because it was applied successfully somewhere else, although the conditions differ materially.

The want of proper provision for dealing with storm water at outfalls is often a fruitful source of trouble. I have had to examine several sewage outfalls where the results were unsatisfactory, and I have found

that failure was mainly attributable to the fact that the discharge at the outfall, through defective construction of sewers or otherwise, of more than three times the normal dry weather flow, which the Local Government Board require to be dealt with as sewage, prevented whatever system of treatment was in operation from having a chance of success. If chemical precipitation was the system, the excessive amount of fluid caused much solid matter to be washed through the tanks which would have been deposited if the flow had been less irregular. If bacterial methods were in operation they were working at a disadvantage, as innumerable colonies of bacteria were being washed away in the beds, their ripeness being thereby destroyed. Waste land of a pervious character, or rough filter beds, if no land is available, should receive discharges due to abnormal rainfall, which should be carefully differentiated from the normal flow of sewage. This admits of fairly close determination, so that an arrangement of works can be designed which will give successful results.

When chemical precipitation was first adopted, the sludge resulting therefrom became a difficulty, as it caused a nuisance. The conversion of the sludge into cakes, by pressing, diminished the difficulty as regards nuisance, and the hope arose that the pressed cake would realize more than the cost of pressing and would prove a source of considerable profit.

Although experience proved this to be fallacious, chemical precipitation is frequently burthened with the cost of sludge-pressing apparatus. Where some land is available this can be avoided by employing chemical treatment to effect the deodorization of the sewage, and to the precipitation of the solids. These may be conveyed in a fluid and fairly inodorous state to the land, to be disposed of and utilized for agricultural purposes without nuisance if dug in promptly. An illustration of this is afforded at the Finchley outfall, where Professor Kenwood has carried out this plan.

In any arrangement of sewage disposal works, a sedimentation tank is now regarded as useful, in order to arrest the suspended inorganic matters in sewage which tend to clog any kind of bed. The great bulk of the inorganic matter is arrested in this tank, provided the rate of flow through it is properly regulated. Some organic matter is also deposited, which is converted into liquid and gas by anaërobic, septic, or cesspit action, the liquid passing away with the sewage. The neglect to adopt this simple preliminary treatment has caused most of the difficulties in regard to the silting up of bacteria beds. By having sedimentation tanks, or other means of arresting inorganic matters, and by using suitable material for the beds, permanent reduction in the capacity of the beds is avoided, or is but trifling.

It has been found that fluctuations in the purity of effluents from bacteria beds will occur when the quality and quantity of the fluid applied varies considerably, which is what might be expected. New bacteria beds require to be treated at the outset with small quantities of fluid, until they have become ripe, that is when the bacterial action has been well set up. By overtaxing a bed its efficiency is diminished, whilst by regulating the amount of sewage that is applied to it the best results can be obtained.

Years ago the Massachusetts State Board of Health conducted a long series of experiments for the treatment of sewage bacterially, by passing it through beds filled with gravel stones, which it was stated afforded the best illustration of what takes place in the purification of sewage, and it was found that "the slow movement of the liquid (even with the coarser suspended matters contained in the sewage) in thin films over the surface of the stones, in contact with air, caused 97 per cent. of the organic nitrogenous matter, a large part of which was in solution, as well as 99 per cent. of the bacteria, to be removed during a period of some months."

There is a great amount of information available as to the results obtained at sewage outfalls by various arrangements of bacteria beds and methods of working. In endeavouring to utilize this, one feels that in many cases there has been an adherence to some particular system instead of comparing different systems and arrangement of works under precisely the same conditions as to volume, composition of sewage, etc. The investigations of Mr. Alfred Creer at the York Outfall, of Mr. G. D. Watson at Birmingham, and of Mr. K. F. Campbell at Huddersfield, deserve especial mention as having been carried out without preconceived views or prejudices.

The arrangement and construction of bacteria beds admit of being determined so as to prevent the efficiency and success of the beds from being neutralised, as they often are, by non-compliance with what experience has pointed out as the essentials. If these conditions are complied with, and if the beds are properly worked, a very large portion of the oxidisable and putrescible organic matters in sewage will be removed, and if the effluent is treated in a second series of beds the highest standard of purity is obtainable. I have examined the cause of failure of beds in several places and have found clogging and inefficiency to be often due to the material containing fine particles which settle to the lower part and partially fill up the interstices. In other cases the beds were being worked without regard to the volume or composition of the fluid applied, both of which are factors in regard to the bacterial purification which is aimed at.

Experience has shown that with a given area of land a much larger

volume of foul fluid can be bacterially treated by the trickling or sprinkling system, than by the contact system. In either case the selection of suitable material for the beds is all important, and that which is used must be governed by the locality. The action of aërobic bacteria in the presence of air admits of ready explanation, and that of anaërobic in a cesspit has long been known. I have not yet had a satisfactory explanation of bacterial life in a bed which is alternately filled, emptied, and left empty, for the recognized eight hour cycles.

Twenty years ago I treated crude sewage at an outfall by upward filtration through tanks with false bottoms, over which was a layer of rough stones. The sewage passed slowly upwards through the stones, leaving the larger suspended solids in the false bottom, where they became liquefied by anaërobic action, and the liquid was pumped on to land, with excellent agricultural results. The filter was rested by stopping the flow of sewage at long intervals, when any organic matter that had been retained in the interstices of the stones became liquefied.

In the report to the London County Council by Prof. Clowes and Dr. Houston (issued this year) the results are given of experiments with crude sewage which has first passed through sedimentation tanks at the rate of a unit volume of sewage in six hours. The sewage passed through these tanks to coke filter beds. The following conclusions are given in the Report (page 33):—

"1. That by suitable continuous undisturbed sedimentation the raw sewage is deprived of matter which would choke the coke-beds, and the sludge which settles out is reduced in amount by bacterial action to a very considerable extent. This reduction might undoubtedly be increased by the preliminary removal of road detritus.

"2. That the coke-beds, after they have developed their full purifying power by use, have an average sewage capacity of about 30 per cent. of the whole space which has been filled with coke.

"3. That the sewage capacity of the coke-bed, when the bed is fed with settled sewage, fluctuates slightly, but undergoes no permanent reduction. The bed does not choke, and its purifying power undergoes steady improvement for some time.

"4. That the coke of suitable quality does not disintegrate during use.

"5. That the "bacterial effluent" of settled sewage from the coke-beds does not undergo offensive putrefaction at all, even in summer heat, and can never become offensive. That this effluent satisfactorily supports the respiration of fish.

"6. That the use of chemicals is quite unnecessary under any circumstances when the above method of treatment is adopted."

The admission of trade wastes to sewers in large quantities causes difficulty to arise in treating the sewage at the outfall, especially when the waste is not admitted at regular intervals coinciding with the varying volumes of sewage, and when undesirable solids are not removed. If the conditions as to the admission of the waste are observed there is no trouble in dealing with it, when it is associated with sewage in reasonable quantities, as the sewage sets up the necessary putrefactive change if the waste is either acid or alkaline, unless in excess, when it should be neutralised before admission to the sewer. In my own practice I have had experience of this, and do not think that there exists any insuperable difficulty in arranging for manufacturers to utilise a sewerage system (when proper safeguards are adopted), as they can fairly claim to do, considering that they contribute to the rates of the town in which their trades are carried on.

In considering the question of pollution, chemical analyses admit at present of a better means of arriving at comparisons than bacterial analyses, as the deductions that can be drawn from the latter are, as yet, a source of controversy.

In determining what standard of purity of effluent should be required, the circumstances of each case will have to be dealt with. Perhaps some minimum standard might be fixed, but there should be no question as to the necessity for carrying out remedial works to prevent crude sewage being discharged into estuaries and rivers to cause nuisance. The nature and extent of the works must be governed by the conditions of the place; as an effluent might be permitted at one outfall which is not chemically or bacterially pure, but where the bulk of the polluting matters having been arrested, the few that remain can be safely left to the purifying influence of the sea, estuary, or river into which it passes.

The requirements of the Public Health Act with reference to the purification of foul fluids before their discharge into rivers, etc., has not been considered as applying to tidal waters, and the Rivers Pollution Act has only very rarely been put in force. Inasmuch as it is illegal under the common law to pollute the air, or the rainfall after it reaches the earth, it is equally illegal to cause a nuisance by polluting the tidal water of an estuary, or the foreshores adjoining, as the Courts have held in cases with which I am familiar.

However skilfully outfall works may be designed and carried out, after all the results depend on efficient management. Some supervision by an official "Inspector of Outfalls" would be an advantage, as it often

happens that an outfall is mismanaged or neglected, with the attendant injury to private interests by nuisance, which involves litigation.

The question of the better conservation of the rainfall of this country is one of national concern, and yet it has not received the attention that it requires on the part of the Government.

Providing water for the communities in a watershed, and removing the fluid refuse from their midst, are so intimately associated that it has often been urged, and properly so, that the country should be divided into drainage areas, forming natural (and not artificial) boundaries coterminous with sanitary districts, so that the needs of the entire population, both urban and rural, within each area should be equitably dealt with. What is imperatively required is an Authority having control over the whole of a watershed area, and responsible to a Department of State. The Royal Commission on Sewage has indicated the desirability of forming River Boards, and the President of the Local Government Board has raised the hope that he will bring before Parliament a Public Health Bill, which would presumably deal with these matters on the lines that have for so long been laid down. I think a Royal Commission would facilitate matters by bringing into definite shape the lines which legislation shall follow.

The past history of our watersheds indicates that they have often been monopolised for the supply of towns whose requirements can only utilise a fractional part of what the watershed is capable of yielding. Many centres of population in rural districts are without any proper water supply, and many are dependent on a well or wells (often far from pure) which fail during periods of draught. I know of many such cases throughout the country, and the requirements of these small communities should not be disregarded as they now are.

We have an object-lesson in the exceptional rainfall of last year. The utilization of the excess water in wet seasons to meet the deficiencies in dry seasons can only be accomplished by the construction of impounding reservoirs in which flood waters would be stored with the double advantages of mitigating the disastrous effects of floods and of better adjusting the balance between supply and demand. In this connection much could be done to utilize the power due to the flow of water from a high to a lower level to which I have devoted much attention, but it is beyond the scope of this address to deal with it.

In considering the question of conserving flood water for town supply, it must be remembered that until quite recently the storage of flood water was objected to, as it was under the ban of being polluted. This leads me to refer to what has removed this ban.

Lord Balfour's Commission on London water had before them a scheme prepared by me for the Water Companies by which at small cost comparatively an impounding reservoir could be constructed in natural valleys of the Thames for the future supply of London. The report of this Commission issued in 1893 was adverse to this, and characterized the storage of flood water as "highly objectionable and undesirable." The report of Lord Llandaff's Commission in 1899 removed the ban, as it stated that "no restriction need be placed on taking flood waters," and also, "it would present a double advantage—the cost of pumping to store would be saved, and it would be possible to take much more water into the reservoir when the river is full as the intake would not be limited by the capacity of the pumps, which cannot deal with more than a fraction of the water passing down at times of flood."

The late Sir Edward Frankland, in a paper at the Royal Institution of Great Britain in 1896, said that "the bacterial improvement of river water by storage for even a few days is beyond all expectations." The better conservation of the rainfall would enable that which is now wasted to be utilized in many parts of the country for irrigation purposes. The present unsatisfactory condition of the landed interests has led to many suggestions with a view to the better cultivation of the land. The establishment of new centres of population by the removal of industries from congested towns to parts of the country where land was going, or had gone, out of cultivation, involved the question of water supply, both for the people thus located and as affording means of cultivating the land surrounding the settlements.

Those who are dependent on underground water for their supply, suffer by the pumping operations of water or mining companies. Although the Courts have held that there is no title to underground water, it must be remembered that this ruling is based on the legal view that water cannot be "identified." In some cases this identification is possible by the employment of lithia, which can be traced, by spectroscopic analysis, considerable distances, as I have had the opportunity of illustrating in a case.

The exceptional rainfall in 1903, and its occurring during the usually hot, dry, and dusty periods, as well as in the usual wet periods, had one good result in preventing the floating dust from being blown about from filthy road surfaces. The effect of this, together with the cleansing of the drains, sewers, and surroundings of houses, was the reduction of the death-rate, that year being one of the healthiest on record, with a death-rate nearly 3 per 1,000 below the average for the previous five years. The adoption of wood-paving and asphalte in our main thoroughfares, although

attended with the advantage of being less noisy (especially as regards asphalte) than the usual macadam road, requires systematic cleansing with hose and water, and good scavenging, especially during warm, dry weather. This is at present very imperfectly done, where it is even attempted, the result being that the air is charged with foul dust from the polluted road surfaces, causing injury to health. The cost of effectively cleansing the main roads of our towns deters local authorities from doing it, but those who regard the matter only as affecting the rates should recognise that the improvement in regard to health, and the increased power of the community to do work, and better work, should be regarded as having a money value.

As bearing upon road sanitation, the present method of preparing the surface of our main roads leaves much to be desired. The employment of asphalte and wood has led to a beneficial reduction in the noise caused by vehicular traffic, but the constant patching of the very uneven surfaces is serious. I am hopeful that in the near future our main roads will be covered in such a way as to be smooth, durable, and as noiseless as any existing arrangement, and I have under observation forms of construction which warrant my entertaining this view. A road thus made would offer a smooth surface for vehicles of all kinds, and when motor traction supersedes to a great extent horse traction, as it no doubt will do, there will result a reduction in wear and tear and noise, together with the all-important diminution of filth and smells.

CONGRESS AT GLASGOW.

SECTION III.—CHEMISTRY, PHYSICS, AND BIOLOGY.

ADDRESS

By Prof. FRANK CLOWES, D.Sc., F.I.C., F.C.S.

President of the Section.

THE subjects which are brought together under this Section are naturally associated. Chemistry, Physics, and Biology, not only constitute an ample field, but provide a conjoint area, the dividing boundaries of which are indefinite or non-existent, and over which each of us must more or less frequently have cause to travel.

It is commonly considered that there is no very satisfactory delimitation of the field of the chemistry as compared with that of the physics, and it is certain that the biologist must concern himself largely with matters both chemical and physical. In respect of sanitary processes, it is indeed constantly found that one and the same purpose may be accomplished by chemical, physical, or biological methods.

Sewage treatment.—Perhaps no better instance of the alliance of these sciences can be given than in their application to the methods of sewage disposal, the discussion of which will constitute an important part of the business of this Congress. At one time the treatment of sewage by chemical processes was almost universally recommended, and discussion mainly turned on what chemical substances were the most efficient in rendering sewage inoffensive; then electrolytic treatment appeared upon the scene; and at the present time the discussion mainly turns upon the various means of applying biological treatment. The resolving action of organisms, which are excessively minute and are ranged at the bottom of the scale, appears to be likely to supplant the attempted purification of sewage by chemical precipitation and the more costly process of electrolysis.

It appears now to be generally conceded that some method of controlled biological treatment will be the generally accepted means of rendering sewage inoffensive, and of providing for its disposal; and it is probably because I have endeavoured to assist in the promotion of this desirable end that The Sanitary Institute has done me the honour of inviting me to preside over the meetings of this Section of their Congress.

When the London County Council decided that I should act as their chemical adviser the experimental treatment of London sewage had already been commenced by my predecessor, Mr. Dibdin, and it appeared very desirable that the experiment should be continued and followed up to a successful issue.

The sewage effluent which results from the chemical sedimentation of London sewage contains much organic matter, which rapidly passes into a foul and putrescent condition during hot summer weather; and its discharge into the lower river has occasionally produced an undesirable condition of the stream in times of heat and drought. The constant flow of upland water in ordinary times is found to prevent any large section of the lower river water from becoming offensive, and the tidal action perhaps assists in mixing the effluent with well aërated water, but the incompletely purified sewage effluent has at times produced unpleasant results in the river. This knowledge was sufficient to lead the County Council to sanction further expenditure on experimental work in connection with the modern biological method of treatment.

Bacterial Treatment by Intermittent Contact.—While the Council's experimental treatment was proceeding, Dr. Fowler was carrying out experimental treatment of a similar character upon the Manchester sewage. In the case of Manchester the rapid development of the treatment on the large scale became imperative, because the effluent was discharged into a stagnant canal instead of passing into a flowing and tidal river as it did in London. It is satisfactory to be able to report that, as far as the experimental bacterial treatment of the sewage is concerned, Dr. Fowler's results and conclusions agreed in every detail with my own, and when the high scientific attainments and practical common sense of Dr. Fowler are generally appreciated, as they must already be by those who know him best, this agreement augurs well for the future of the processes which have received his support and adoption. Owing to the necessity of pushing the treatment of sewage at Manchester rapidly from the experimental to the large scale, the Manchester treatment is at the present moment of extraordinary interest, as one is able to see in the Manchester sewage

works a successful, economical, and well-established bacterial treatment of the whole of the sewage of a large city proceeding in a satisfactory manner.

The process successfully adopted for Manchester, and which in the interests of Londoners one must hope to see soon adopted for the metropolis, consists in freeing the sewage from its heavy grit and coarser matter, and then allowing it to undergo sedimentation in large tanks through which it passes very slowly. The sediment in these tanks is mainly of an organic nature, and if left undisturbed a large part of it disappears by resolution into liquids and gases under the action of bacterial organisms contained in the sewage itself. The effluent from these tanks, after being freed from some dissolved gases by falling over a weir, is passed into coke-beds, which remain filled for several hours alternately with effluent and with air. Here further and special bacterial action frees the effluent from its easily changeable and putrescible organic matter, and enables it to be delivered into a water course in such a condition that it causes no offence and does not even lead to reduction in the aëration of the water. It accordingly leads to no nuisance and does not prevent the respiration of fish. The Congress will shortly hear from Dr. Fowler an important communication on his recent experience of this treatment.

Special bacterial estimations have shown that the treatment described above produces a very appreciable reduction in the number of bacteria present in the sewage.

The following extract from a paper communicated by me last April to the Society of Chemical Industry, states the nature of these experiments and gives the results obtained:—

"Two classes of sewage in different localities were placed under careful observation, the cultures for counting the colonies which developed being put down at the time and place of collection of each sample.

"One sewage was of purely domestic origin, being that derived from the residents in Christ's Hospital, Horsham. The sewage flowed into a settling tank, its passage through which occupied about 24 hours. The effluent passed through coke-beds contained in shallow tanks which were alternately allowed to stand full of effluent and full of air. The bacterial action taking place in the settling tank disposed of all the settled suspended solid matters, and the subsequent bacterial action in the coke-beds removed all putrescible dissolved matters.

"The other sewage which was placed under observation was the average sewage delivered to the Northern Sewage Outfall Works from the sewers of North London. This sewage had been roughly screened, then mixed with small proportions of chemicals in order to expedite the subsequent sedimentation during its slow passage through settling channels, and the effluent from these channels constituted the feed to an intermittently worked coke-bed which was similar to that at Horsham. The feed to this bed, and the effluent from it, were subjected to systematic bacterial examination.

"It should be stated that the lower part of the coke-bed at the Northern Outfall consists of somewhat fine and compacted material, which may to some extent mechanically reduce the number of bacteria. It should also be explained that the screened London sewage contains only finely comminuted fæcal matter, because it has been subjected to the process of pumping and a flow of many miles. The Horsham sewage, however, contains comparatively unbroken fæces, since it has flowed by gravitation only for a short distance. This would probably tend to diminish the number of bacteria found in the Horsham sewage, since the sample was collected by dipping the liquid from a collecting chamber outside the settling tank. Both sewages were clarified by passage through a filter-paper before they were subjected to cultivation.

"It is necessary to calculate the decrease in bacteria from the average results, since the samples of effluent obtained on the same day cannot altogether correspond to that day's discharge of untreated sewage.

"It may be noted that the results obtained from each of these samples when put down at once for cultivation were compared with the results obtained by putting down the same sample 21 hours after its collection. The average percentage increases in the number of bacteria counted, after keeping the samples 21 hours before cultivation, were 106 in the case of the sewage, 60 in the effluent from the tank, and 54 in the effluent from the coke-bed. As might have been anticipated, the highest rate of increase occurred in the most largely polluted liquid, and this indicates the necessity of not delaying cultivation of impure liquids which are under bacterial examination. It was found that a delay of 21 hours not unusually occurs between the collection of a sample and its arrival at and cultivation in the laboratory. This delay evidently leads to results which, in certain cases at least, do not correspond with those which would be yielded by the sample at the time of its collection, and in series of samples, such as those taken above, the delay very seriously affects the ratio between the numbers of bacteria found in the different series.

"In the case of the London sewage, samples were taken every ten minutes during the filling and emptying of the coke-bed, and the samples of sewage taken on each day were mixed to form the average sample for examination for that day, the average sample of effluent being obtained in a similar way. The average numbers at the foot of Tables I. and II. furnish a fairer means of judging the extent of reduction in the number of bacteria than the daily numbers do, since the effluent and feed of the bed on the same day are not precisely corresponding liquids.

"It will be seen that in the case of both sewages a marked reduction in their bacterial content takes place. As far as the effluent from bacteria beds is concerned, it appears, therefore, to be not proved that the bed is a means of increasing the number of bacteria; the bacteria rather appear to carry out their active functions in the bed, and to pass away in large numbers in the effluent in a lifeless condition.

"The results obtained are summarised in the following Tables I. & II.:—

TABLE I.—*Average Samples from the Barking Coke-bed.*

Date, 1903.	Total Number of Bacteria per c.c.	
	Settled Sewage.	Coke-bed Effluent.
May 9th	8,000,000	70,000
„ 13th	11,500,000	814,000
„ 14th	5,300,000	829,000
„ 16th	10,000,000	1,180,000
„ 19th	10,800,000	Lost.
„ 20th	6,600,000	1,070,000
„ 27th	7,900,000	1,675,000
Average number	8,585,714	939,667
Percentage reduction in the number of bacteria		89

TABLE II.—*Average Horsham Samples taken quarter-hourly during maximum flow of Sewage.*

Date of Collection, 1903.	Total number of Bacteria per c. c. (average of Cultivations).		
	Crude Sewage.	Effluent from Settling Tank.	Effluent from Coke-beds.
June 9th	7,300,000	13,650,000	8,750,000
„ 12th	9,800,000	10,850,000	9,500,000
„ 16th	9,000,000	5,750,000	6,650,000
„ 19th	8,750,000	9,800,000	8,050,000
„ 23rd	12,700,000	8,200,000	5,100,000
July 8th	16,450,000	3,650,000	3,000,000
„ 14th	23,450,000	21,700,000	18,200,000
Average numbers	12,492,857	10,514,285	8,464,285
Percentage decrease in numbers	...	15·8	32·2

The bacterial examination of the water of the Lower Thames was made in a manner similar to that described above, and has shown that the bacteria introduced into the river in the sewage effluent become progressively reduced in number as the effluent passes down stream. It has also been shown that the disappearance of certain of the organisms of intestinal origin was complete after a flow of some miles.

An extract from the paper in the Journal of the Society of Chemical Industry, which was referred to above, furnishes the following results :—

"*The total number of Bacteria in the Sewage Effluent* discharged at both outfalls is as follows:—

Date and Outfall.	Bacteria which grow at 20° C.	Bacteria which grow at 37° C. (Blood-heat.)	Aerobic Spores.	Number of Estimations.
Barking, March, 1903	8,585,714	5,100,000	234	Average of 7 Samples.
Crossness, June, 1903	6,300,000	......	...	Average of 6 Samples.
Average	7,442,857	......	......	......

"The average for both outfalls is therefore 7,442,857.

"*Reduction in number of Bacteria by passage down river.*—The samples were taken from the surface water by dipping, and were collected at low water in mid-stream and near either shore. The average of the results obtained from six series of samples collected on the 3rd, 4th, 5th, and 6th of March, 1903, are stated below:—

Locality.	Approximate Distance in Miles from the Crossness outfall.	Average Number of Bacteria per c.c.
Mucking light	21·3	4,837
Hole haven..	24·3	3,431
Chapman light	27·0	1,662
Yantlet creek	29·5	711
Southend pier	31·5	379
Garrison point	33·5	381
Nore light	35·8	186
Below the Nore..	39·3	145

"It will be seen that the average number of 7,442,857 bacteria per c.c., which were present in the sewage effluents discharged from the Barking and Crossness outfalls, have become reduced by the action of the river-water to 4,837 at a distance down-stream twenty-one miles from Crossness, and that off Southend, 31 miles from Crossness, a further reduction to 397 has taken place. When the Nore light-ship is reached, the bacteria number only 186 per c.c.

"Each water-sample was further examined for gas-forming bacteria, which are generally considered to be those of intestinal origin. Out of forty-five samples examined, only seven contained such bacteria, and these seven samples were all of them collected between the Mucking and the Chapman lights. No gas-forming bacteria were found in the water below the Chapman light. Hence it appears that the intestinal bacteria in the sewage effluent had disappeared from the river twenty-seven miles below the point at which they had been introduced into the stream."

Probably the introduction of these sewage bacteria into the Lower Thames and into the Manchester Ship Canal is of little importance. It might be well to insure their removal in other special cases, although it must be remembered that the vast majority of them are harmless, and are engaged in the beneficial work of further purifying the diluted effluent.

With regard to the sediment from the sewage, this has been found to disappear entirely when the sewage is of domestic origin, as it is for instance at Christ's Hospital, Horsham. In the case of a town's sewage, however, a portion of it will probably resist bacterial action and the residue will require to be occasionally removed.

Bacterial Treatment by Continuous Contact.—The method of applying bacterial treatment described above is generally termed treatment in the septic tank followed by intermittent contact in the coke-bed. It is well known that other methods of utilising the action of bacteria for the treatment of sewage are in vogue. In addition to the older treatment on land in the sewage farm, which is bacterial in nature, there is the much more modern continuous treatment in bacterial beds. The continuous method consists in spraying the effluent from sedimentation over a coke-bed which is freely open to air at its surface and sides. The mass of coke is accordingly never submerged, as in the intermittent method, but the liquid is continually dripping through the bed and the effluent is constantly passing away.

It is important that the fullest information should be furnished as to the relative advantages of the intermittent and the continuous methods of applying the final bacterial treatment: and it is to be hoped that one of the important results of this Congress may be the collection and dissemination of these useful data.

My personal experience leads me to favour, under the conditions of the London treatment, the adoption of intermittent contact. As compared with the continuous system, the intermittent appears to possess the advantage of passing the sewage more rapidly than some of the continuous methods, of requiring plant which costs less for its original installation and for its maintenance in good working order, and it appears to have the further advantage of furnishing an effluent which requires no final process of sedimentation after bacterial contact.

But there is little doubt that the statistics concerning continuous treatment are as yet by no means as complete as is desirable, and it is very possible that when fuller knowledge of the merits of the two processes

is available, it may be found that one or other method is preferable according to the varying conditions required for different localities.

It has been my good fortune as adviser to the London County Council to have had the opportunity of originating the bacterial treatment of sewage in several localities, and of watching the process in these and in other installations; while occasion has also arisen for inspecting most of the more important and typical sewage works in this country. I may state my conviction, founded now on many years' experience and observation, that this natural method of treating sewage is more rational and economical in practice than any other; that it is the only practicable means of dealing with the dissolved organic putrescible substances of the sewage; and that in dealing with ordinary domestic or town sewage, it has been invariably successful and devoid of offence wherever it has been properly installed and reasonably carried on.

It has already been stated that the bacterial treatment includes the treatment on land as well as the more modern controlled treatment in so-called contact beds. Unfortunately a sewage farm is only exceptionally possible for the treatment of town sewage; but, on the other hand, instances exist where suitable soil and ample area has been found and long runs of successful treatment of sewage on the land have been recorded. The more compact method of bacterially treating sewage in artificially prepared spaces is on the other hand everywhere applicable, and has the great advantage of being under easy control, of maintaining a constant and trustworthy action, and of furnishing a satisfactory and unvarying effluent.

Standards for Sewage Effluents.—It will be of great advantage to have at first hand from Dr. Dunbar, who has done classical work in connection with sewage treatment at Hamburg, an expression of his opinion respecting standards of purity for sewage effluents. Every one who has been interested in these matters will appreciate the great difficulty of laying down suitable limits to the organic and bacterial impurity of these effluents. Probably even the suggestion of the Rivers Pollution Commissioners, that an effluent should not be more impure than the water into which it is discharged, would not serve as a universal standard, although the suggestion might be found to furnish a generally useful standard in most cases.

Bacterial contamination of Shell Fish by Sewage.—It is also well that the special question of the infection of shell fish by the bacteria derived from sewage, should receive further public consideration. My own

independent examination of the Lower Thames and of the Thames estuary fully bears out the general conclusions on this matter which were arrived at by the Royal Commission on Sewage Disposal. A lengthened bacterial examination of the estuary in a large steamer fitted out solely for bacterial examination showed that the average condition of the estuarial water was practically in as satisfactory a condition bacterially as the water of the open German Ocean.

Quoting again from the paper referred to above, a statement is furnished of the bacterial examination of the water of the North Sea and of the Thames estuary, and the results obtained by these examinations are tabulated.

"*Number of Bacteria in the Water of the North Sea.*—A bacterial examination was made of the water of the North Sea by collecting samples of the surface water in the neighbourhood of the Galloper lightship, which is stationed about twenty-five miles seaward of the sea-end of the Barrow deep, and is therefore in the open sea.

"Samples of water were collected every five minutes for two hours, and equal volumes of the samples taken during each half hour were mixed together to constitute one average sample. In this way four average or compound samples were produced and were subjected to cultivation in the manner already described. The following results were obtained:—

	Number of Colonies per c.c.
High water, 11th April, 1903, 11.40 p.m.	373
5.5 a.m. to 5.35 a.m.	215
5.35 a.m. to 6.5 a.m.	191
6.5 a.m. to 6.35 a.m.	357
6.35 a.m. to 7.5 a.m.	298

"Tests were made for *bacillus coli* and for *bacillus enteriditis sporogenes*: neither organism was detected in 1 c.c. of the water.

"The results indicate that the open sea water contained a small number only of bacteria, an average of 287 per c.c.; and that what are ordinarily considered organisms of intestinal origin were absent.

"*Bacteria in Sewage 'Sludge.'*—The bacterial condition of the 'Sludge,' or matter separated from the sewage by sedimentation, may be stated before the bacterial examination of the estuary water into which the sludge is discharged is referred to.

"A comparison of the bacterial condition of the sewage sludge with that of the water of the estuary will indicate the reduction in the number of bacteria effected by dilution and by other means after the discharge of these organisms has taken place.

"*Number of Bacteria in* 1 *c.c. of* '*Sludge*' *at both Outfalls.*

Barking, 1903.	Bacteria which grow at 20° C.	Bacteria which grow at 37° C. (Blood-heat).	Spores.
April 29	121,000,000	60,000,000	6,250
May 2	126,000,000	74,200,000	8,100
" 4	119,500,000	45,000,000	10,550
" 5	131,000,000	64,000,000	11,800
" 6	135,000,000	70,000,000	11,400
Average	126,500,000	62,640,000	9,620

Crossness, 1903.	Total Number of Bacteria.	Number of *Bacillus Coli Communis.*	Number of *B. Enteriditis Sporogenes.*
June 8	118,000,000	At least 1,000,000	At least 10,000, but not 100,000
" 9	57,000,000	At least 10,000, but not 1,000,000	" "
" 10	149,000,000	At least 1,000,000	" "
" 11	163,000,000	" "	" "
" 12	132,000,000	" "	" "
" 13	177,000,000	" "	" "
Average	132,666,666	....	....

"The average number of bacteria in the sludge is therefore 129,583,333 per c.c.

"*Reduction in Number of Bacteria per c.c. introduced into the Estuary Water by Sewage Sludge.*—Several series of examinations have been undertaken at different times with the view of ascertaining the bacterial content of estuary water into which sewage sludge is constantly being introduced, and very many samples have been subjected to examination. The following statement briefly summarises the results obtained:—

"On April 2nd and 3rd, 1903, surface samples were collected throughout the length of the Barrow deep in the estuary immediately after the fleet of sludge steamers had deposited their sewage sludge. The average number of bacteria found in the water was 1,940 per c.c., as compared with 129,583,333 contained in the discharged sludge.

"On the 9th and 10th April, 1903, the surface water flowing from the Barrow deep into the river during an incoming tide was examined. This represented the estuary water which had been mingled with sludge in the estuary. Samples were taken every five minutes throughout the time of rising tide. The average number of bacteria found per c.c. was only 458.

"During September, 1903, further experiments were made with the view of ascertaining whether the diminution in the number of bacteria was due to sedimentation or to lateral diffusion by dilution. Immediately after the dark-coloured sludge had been discharged, a drifter, which was suspended from a float, and was cross-shaped and 8 sq. feet in area, and which

remained 10 feet beneath the surface (the depth at which the sludge is discharged from the bottom of the steamers), was immersed in the discoloured water. This enabled a boat to be kept in the middle of the area of discharge for the purposes of taking samples at different depths. The examination of these samples furnished the following results. Samples were taken every five minutes, and those collected during each hour were mixed to produce an hourly average sample.

Date, 1903.	Interval after Discharge of Sludge, at which Sample was Collected.	Total Number of Bacteria per c.c. found at following Depths.		
		Surface.	10 Feet.	40 Feet, or Bottom.
September 28	None	940,000	13,000	140
	One hour	32,700	2,910	690
	Two hours	1,470	790	320
	Three „	340	140	130
	Four „	380	220	...
„ 29	None	8,000	2,000	...
	One hour	21,400	580	...
	Two hours	6,200	700	...
	Three „	5,800	610	...
	Four „	5,300	610	...
	Five „	1,700	500	...

"These results seem to indicate that the number of bacteria per c.c. is not reduced by the sinking of the organisms to lower levels in the water, but by a lateral diffusion or mingling.

"The final series of samples, bacterially examined, consisted of water taken at different depths in the different channels of the estuary, of the bottom materials, and of the sands which were exposed at low water. In no case were bacteria found to be present in any considerable number."

The examination of the lower river shows that it is constantly undergoing bacterial improvement in its downward course, and that it does not even contribute materially to the increase of bacteria in the open estuary.

As a body which is primarily concerned with safeguarding the health of the people, the members of The Sanitary Institute will doubtless be desirous of preventing the continuance of any proved means of damage to public health and well-being, but they would surely strongly deprecate the publication of unnecessarily alarmist statements, as these are calculated to injuriously affect industries and to unnecessarily alarm the public. But it is undoubtedly the case that the official reports on the danger of contamination of shell-fish have shown that local sources of pollution have existed in the immediate neighbourhood of oyster layings, and have led to necessary improvements and safeguards.

The Study of Disease and of its Propagation.—The presentation to this Section of other papers bearing on specific diseases indicates that those who are the guardians of the public against the few surviving plagues, are keenly alive to the important duties which they have undertaken, and that they hail these recurring opportunities of arriving by conference and discussion at the best means of effecting their ends.

Purity of Food and Air.—One most important means of maintaining the public health at a satisfactory standard is to secure the reasonable purity of the food and drink consumed by the people, and to secure the purity of the air both within and without their buildings. Those who watch constantly over the quality of the supply to the food market and over the quality of water supplies are intrusted with functions of the greatest importance, and they should receive the support of all who wish well of their kind. Experience suggests that relaxation in such examination is impossible, and points to the necessity of increasing the frequency and rigour of such examinations. The public should welcome any improvement or extension in the working of the Food and Drugs Act, and should insist that the water supplies of the country should be proved to be satisfactory, not only as regards their original sources, but as they are supplied to the consumer. All experience shows that the public health is largely affected by the quality of the food and drink which is supplied to consumers.

In order to secure the purity of the atmosphere of towns very much remains to be done. Manufactures which emit offensive odours are generally banished from the immediate vicinity of densely populated areas, but the manufacturers are under no sufficient requirement to destroy their offensive emanations, a result which might generally be easily effected. Further, over our areas of dense population, not only the manufacturer, but, to an even larger extent, the private householder seems to make it a matter of little or no concern to avoid the emission of the objectionable products of the imperfect combustion of raw coal. The coal smoke of our great towns has become a serious nuisance and source of damage to materials and to health; and it must be remembered that it is accompanied by a very appreciable quantity of sulphuretted hydrogen, which is always present but is more especially evident in stagnant and foggy weather. This gas is not only very injurious to health, but does much damage by tarnishing metals and by impeding vegetable growth. The increasing use of coal-gas, petroleum and electricity for heating and motor purposes is advantageously reducing these particular sources of

atmospheric pollution, but the results thus far attained are very far from securing a satisfactory condition of the atmosphere. The combustion of much of our raw coal produces also a considerable amount of oxidised sulphur, the effect of which on living plants is bad, while its hygienic effect has been seriously condemned by those who are in the best position to express an opinion. The destructive effect of these acid sulphur products on leather fabrics and metals has also been placed beyond question. Naturally in ordinary weather these acid products do not accumulate in the air of a town: they become largely diluted and are frequently removed by falling rain: but their presence in the air within our buildings is cercertainly to be deprecated; and the desirability of extending the supply of coal-gas, which is not purified as far as possible from sulphur-compounds, for interior illuminating and heating purposes, should receive the thoughtful consideration of sanitarians and of householders. Speaking generally, the purity of the air we breathe receives at the present day less serious attention than the purity of our food and drink, and of materials which are used for various purposes.

It only remains for me to wish continued success to this important Sanitary Congress assembled in our great and important northern metropolis, and to express the hope and the belief that our deliberations may serve to advance the weighty interests which we have assembled here to promote.

CONGRESS AT GLASGOW.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

ADDRESS

By Councillor W. F. ANDERSON, J.P.,
Chairman of Committee on Health, Glasgow.
PRESIDENT OF THE CONFERENCE.

IN the remarks which I propose to offer you, as President of the Municipal Section of this Congress, it would be futile for me, in the presence of the expert sanitarians before me, to make any attempt to cover, even by a general survey, the progress of municipal sanitation. To look back upon the past and measure the distance we have travelled is undoubtedly useful and salutary, and in the case of the rapid growth and condition of our civilian population, is to my mind also somewhat depressing. The cry has already gone forth in many directions all over the world, and in no country more urgently than in our own, "Back to the Land." That cry I would repeat with emphasis now, if I could bring myself to believe there was in it the essence of practical politics or social salvation. We hear from writers such as Prince Krapotkin in his "Fields, Factories and Workshops," of the marvellous prodigality of nature in agriculture when she is wooed in earnest, and in ways suggested by scientific farming; while, on the other hand, we have such writers as Mr. Rider Haggard showing the drudgery, poverty, and distress which prevail in many parts of rural England, when capital is deficient, and where the housing of the labourers is almost as bad as, if not even in some respects worse than, it is in our city slums. We know of the disgrace of the "Bothy" system, of the rotten and damp condition of many of the dwellings in which our miners live, and we have recently had in our own city evidence of how the labourers in the country may contract a disease of the most virulent type (small-pox), and, all undetected, bring it from thence into the centre of a teeming population.

We have heard of "Garden Cities" into which our city workers may be enticed and segregated under conditions approximating those which existed in the imagination of Sir Benjamin Ward Richardson as he wrote his "Hygeia." But, co-ordinate with these, we see the growth of London, Liverpool, Manchester, Glasgow, and many others going on apace, spread-

ing out their stone and lime into the green fields, and converting their herbage into paved streets and row-upon-row of tenement property.

The ideal is the Country and the Garden City, and it is likely to remain an ideal only so long as the present land tenure is permitted, but the real is the apparently everlasting extension of large cities, as we find them at this present hour. Considerations as to the improvement of the real, therefore, appear to me of more practical utility than speculations in the region of the ideal.

To this end, therefore, I propose to say a few words on some of the aims the sanitary and social reformer ought to have in connection with the life and progress of civic populations. It has been said that in this city there is a tendency to do too much for the citizen—that, in fact, we seek to look after his interests "from the cradle to the grave." It is hinted, if not expressed, that by this means we are knocking all individuality and self-care out of him. We are trying to suckle him properly at his birth; to educate him during his adolescence; to provide labour, vehicular conveyance, and housing for him during his manhood; parks, music and libraries for him in his recreation; nurse him in sickness; and to provide him, in his senility and death, with a cheap and becoming grave.

Now, there might be some ground for the criticisms of the cynical philosopher if life in a city could be segregated to any extent, as we find it in the country areas. There, a man's or a woman's misdemeanours or carelessness, or want of moral fibre, or physical ability, reacts only on himself or maybe on his family; but, in a city, matters are different. Each unit of a town's population is so closely united in the matter of health and social welfare to those of his neighbour, that self-protection—leaving all altruistic considerations out of view—demands our closest attention.

I need not illustrate my meaning by examples. The ratepayers appreciate, only too well sometimes, the results that may flow from a careless or supine administration. The enormous cost of our hospitals, of our police, of our asylums, and poorhouses, proclaims the responsibilities of all cities, and demands means and expenditures for the alleviation of the misery and suffering of the poor and becomes a constant and ever-increasing drain on our resources.

It would occupy too much time to pass in review all the problems that meet us in our endeavours to find the right means towards our endless ends. You will be called to discuss the Smoke Problem by our esteemed Lord Provost; our Housing Problem by Sir Samuel Chisholm; our Drainage Problems by Dr. Crawford; and, finally, our methods of Health Administration by Mr. Cooper, the Chairman of Public Health in Aberdeen, all of which will be dealt with in a masterly manner; so I propose

to confine myself to the two extreme ends of the citizen's life, namely, his first days and his last.

One problem that has forced itself into my heart is the tremendous and seemingly irreducible infantile death-rate, and we had it on the highest authority of the President of the Sanitary Association of Scotland at the Stranraer meeting last Autumn, that one of the most important problems seeking early solution is that of infantile mortality. "One of the significent features of present-day statistics, and one calling for the serious consideration of sanitarians, is the high prevailing rate of infantile mortality in populous centres." While the general death-rates of our cities were on the decline, and while the death-rate from phthisis had fallen 10 per cent. in thirty years, while the death-rate in our hospitals for scarlet, enteric, and diphtheria had been reduced tremendously, yet the death-rate of our infants under one year was unduly high; not a whit decreased, but in some cases actually increased. In the census year (1901) the town of Burnley lost 226 out of every 1,000 infants born before they attained their first birth-day, Preston being next with a rate of 216 per 1,000. During the ten years (a time which is reliable for averages) from 1888 to 1897, the death-rates of infants per 1,000 births were as follows in the various towns :—

Liverpool	189	Dundee	176
Manchester	185	Glasgow	146
Birmingham	180	Aberdeen	141
Sheffield	180	Edinburgh	140
Leeds	178		

I was anxious to ascertain how English and Scottish cities compared with foreign cities in this important respect, and put myself into communication with our foreign Consuls in some sixty of the cities throughout the world. I selected the year 1902, and that from climatic conditions was not favourable to a high death-rate.

In Glasgow in that year 3,168 infants succumbed, representing a death-rate per 1,000 born of 128. The following are the corresponding rates of infantile mortality in the British towns :—

Liverpool	163	Dundee	143
Birmingham	157	Aberdeen	137
Manchester	152	Edinburgh	123

while the medical officer remarks in his report when giving those figures: "Amongst Scotch towns the infantile death-rate in Glasgow was exceeded in both Aberdeen and Dundee, while in the English towns referred to it was uniformly higher than in Glasgow."

TABLE *giving the Population, General Death-rate, and Infantile Death-rate of some of the Principal Cities of the World.*

City.	Population of City.	Death-rate per 1,000 in 1902.	Infantile Death-rate in 1902, stated per 1,000 of Infants born.
New York	3,838,024	18·74	169
Paris	2,700,000	20·10*	142*
Berlin	1,965,000	15·64	181
Chicago	1,900,000	14·50	Unreliable.
Vienna	1,779,869	19·02	185
Philadelphia	1,408,154	17·67	155
St. Petersburg	1,248,122	21·80	250
Moscow	1,173,469	33·00†	Not obtainable.
Constantinople	875,000	14·47	Not obtainable.
Buenos Ayres	870,000	16·20	91
Rio de Janeiro	793,000	20·00	197
Warsaw	780,000	17·89	157
Hamburg	743,860	17·70	Not obtainable.
Buda-Pesth	733,358	19·20	144
St. Louis	700,000	17·00	182
Boston	600,929	18·78	145
Amsterdam	548,244	15·39	141
Naples	571,797	25·00	149
Baltimore	541,000	18·70	275
Barcelona	533,000	23·63	143
Munich	520,000	21·40	240
Milan	506,510	21·27	147
Dresden	495,400	17·43	192
Odessa	492,000	23·60	172
Marseilles	491,161	22·55	162
Rome	462,783	18·70*	Not obtainable.
Lyons	459,099	18·02	122
Prague	450,000	15·42	144
Breslau	445,766	22·70	215
Copenhagen	411,000	14·50	137
San Francisco	410,000	20·67	175
Cologne	407,000	20·50	Not obtainable.
Cincinnati	375,000	17·09	Unreliable.
Lisbon	360,000	27·52	Not obtainable.
Rotterdam	357,476	15·04	133
Turin	352,060	18·74	142
Yokohama	324,795	14·00	Unreliable.
Frankfort-on-the-Main	313,600	14·78	139
Stockholm	305,115	14·37	100
Riga	300,000	20·00	Unreliable.
Antwerp	294,669	17·00	163
Washington (D.C.)	289,596	19·99	Not obtainable.
Bordeaux	257,471	20·26	117
Christiania	225,709	14·66	100
Lille	220,713	24·63	221
Brussels	192,282	17·70	146
Oporto	171,910	29·10	Not obtainable.
Nagasaki	154,727	11·12	324
Seville	148,315	33·78	200
Gothenburg	133,625	14·80	Not obtainable.

* Figures for 1901. † Figures for 1900.

From this list it will be noted that, in comparison with the larger cities in the world, the great cities in this Kingdom show favourably, as, out of the list I have read to you, no less than seven of the foreign towns lose annually one-fifth and over of the infants born.

It is rather curious that the city which bears the palm in this respect is the capital of the Argentine Republic (South America), with a population of 870,000, and a general death-rate of 16·2 per 1,000; while, next in the order of merit, we have the two Swedish and Norwegian cities of Stockholm and Christiania, with a record of 100 each.

Those three cities, therefore, give us what may be practically considered the "low-water mark" of infant mortality; and it appears to me that no city or town in the United Kingdom should be satisfied until it attains to a similar infantile mortality.

Extract from Annual Report of the Medical Officers of Health for 1903.

Infantile Mortality.

3,563 deaths of infants under one year occurred, which represents a death-rate per 1,000 born of 142, as compared with 128 in 1902. Of these deaths 3,116 were of legitimate and 447 of illegitimate children, representing rates of 132 and 298 respectively per 1,000 birth of each class. For several years this rate per 1,000 born of each class has been:

	1898.	1899.	1900.	1901.	1902.	1903.	Total.	Avg.
Infantile death-rate of legitimate children,	147	143	145	141	126	132	834	139
Infantile death-rate of illegitimate children,	302	286	286	269	244	298	1685	241

and the rate of both classes during several periods has been as follows:—

Average of five years,		1886—90	=	143	per 1,000 births.
"	"	1891—95	=	146	"
"	"	1896—1900	=	151	"
"	"	1901	=	149	"
"	"	1902	=	128	"
"	"	1903	=	142	"

There can be no doubt that the question of legitimacy and congenital causes has a considerable bearing upon the problem; but even eliminating these, I am convinced, on studying the figures given for our own city, that the death-rate of legitimate infants is far too high. For instance, the death-rate of legitimate infants per 1,000 born in Glasgow in the year 1902 was 126, or about an eighth part of the total births in that category; whereas the combined rate for both legitimate and illegitimate in the three foreign cities I have named is a tenth and under.

It behoves all sanitarians, therefore—and not only sanitarians, but our legislators as well—to give the most earnest heed to this drain upon what after all must be considered as the life-stock of the nation, and to enquire what are the causes which produce this great waste of infant life. If we once get to understand and appreciate the true causes, it ought not to be for long a difficult matter to make up our minds as to the best courses to pursue in order to put a stop to it.

In a recent work by Dr. Leslie Mackenzie, of the Local Government Board, Scotland, he points out that about one-third of the total deaths of infants occur in the first month of life; and he is emphatic on the point that, of the three selected tendencies at work in child-destruction, unquestionably the most important is feeding, and proceeds:—

"If a correct diet is habitually insufficient in quantity, the nutrition is more or less arrested; if an incorrect diet is more than sufficient in quantity, the nutrition is perverted. In the one case starvation results, with the diseases following on it; in the other case special nutritional diseases result, such as scurvy, rickets, anæmia, purpura, etc."

This opinion is amply supported by Professor Glaister, the President of the Preventive Medicine Section of this Congress, who places prominently, as one of the causes, the wilful abstinence on the part of mothers from suckling their offspring, and the physical unfitness of mothers for that duty, owing to constitutional disabilities.

Of course, other causes are not lost sight of by either of the gentlemen named, viz., unhealthy housing, careless and demoralised parents, the daily absence of working mothers at their labour, insufficient clothing in winter, and so on, all of which require our careful consideration and attention.

My purpose to-day, however, is to lay special stress upon the question of the improper and insufficient feeding of infants, and the known prevalence of intestinal trouble, due to the improper food which is received by these little ones who are not suckled by healthy mothers. At a coroner's inquest recently held on the death of an infant in London, the mother said she couldn't understand why the baby didn't live as it got a share of all that was going, even up to the beer.

The Professor, in his presidential address last year at Stranraer, instances the remarkable results of an inquiry that was made at Boulogne into the death of 69 infants, who had died there of diarrhœa. Investigation revealed that, out of this total of 69, 8 were fed on the milk of the mother, 20 were brought up on the bottle, and 41 were fed on different forms of solid food. We may take this, I think, as an unmistakable indication of the cause of our infantile mortality.

In considering the report of the Royal Commission on the subject,

although their words apply more to the improper nutrition of children of school age, I fully adopt them in connection with the nutrition of infants. They say, *inter alia*:—

"The proper selection, cooking, and preparation of food may often be matter of serious difficulty to many parents. It would be, in many cases, an inestimable advantage could regular and sufficient meals—such as broth, porridge and milk, or bread and milk—be provided at a minimum cost. The preparation and cooking of these meals, where it is found necessary to provide them, ought to be regarded as one of the charges incidental to school management."

What is true in the case of school-children is equally true with regard to the selection, cooking, and preparation of infants' food. All those who are acquainted with the upbringing of the babies in the poorer districts of cities know well the amount of carelessness and ignorance which prevail, especially as to their feeding. Probably ignorance is more to blame than carelessness, for we all know that Nature herself—except in those who are absolutely debased—works strongly in the mother towards the welfare and comfort of her child. This has been so well recognised that we now find that various towns in this country, and also foreign cities, are now paying special attention to the preparation and distribution of milk suitable for the sustenance of healthy infant life.

It might be useful for the Conference to know what I have ascertained is being done in this connection in some of these. For instance, in *Barcelona* the municipality have a depot where such milk is sterilized and given *free* to the children of the poor.

In *Moscow* the municipality possess about 100 cows, the milk from which goes to the foundlings' home and the town hospitals. Private firms pasteurize their milk at a temperature of 56° Reaumur—equal to 158° Fahrenheit. It is sold there in sealed bottles, each holding about two and a half tumblerfuls, and costing 1¾d. a bottle.

In *St. Louis* (*U.S.*) all the dairy companies are required to treat their milk "as directed by the city chemist." This is usually done by sterilizing it; and recently a gentleman of that city donated to the Corporation a fund to be used in establishing plant to pasteurize the milk furnished to the poor of the city, which is to be supplied upon prescriptions from regular physicians.

From *New York* I have the information that there is a plant for sterilizing milk on Randall's Island, where poor and otherwise homeless children are cared for. This plant was gratuitously installed in 1898 by the Hon. Nathan Strauss, and the result, through a series of years, shows that the lives of many children have been saved in consequence. The

death-rate of the children in this Institution by this means was reduced from 42 per cent. in 1898, to 18 per cent. in 1901. Mr. Strauss also, with consent of the City authorities, established in the City parks and such public places, during the hot months of summer, depots for the gratuitous distribution of pasteurized or sterilized milk, as well as different grades of modified milk for sick children. The New York public generally may patronise these depots, and by paying at the rate of two cents. per pint, may consume all they desire on the premises.

The City of *Lyons* has nine depots, where sterilized milk is given out *gratis* to the poor.

In *Bordeaux* the milk is sterilized or pasteurized by the sellers, and sold at the average price of 3d. per litre or quart. *In that city all cans containing skimmed milk require to be clearly marked.*

The most of you are aware of what is being done at St. Helens, Liverpool, Salford, Bradford, and other towns in England. Here in Glasgow we have also made a start in this direction, and have established our first Municipal Dairy in Osborne Street, with suitable appliances and machinery for preparing and distributing to all citizens who may desire it sealed bottles of suitably modified and sterilized milk for the use of our infantile population at various ages from birth up to one year. I hope that all those who take an interest in the well-being of city children will take sufficient interest in the matter to visit that depot.

It now only remains to ascertain the best means whereby this suitable diet can be put into the hands of mothers and other guardians of infants. Recently we had a deputation from a body of ladies deeply interested in this question before the Committee on Health, by whom we were urged to take suitable and immediate steps to bring to the knowledge of the whole of our poorer classes the importance of properly feeding and rearing their little ones.

We have had for many years six lady inspectors, whose duty it is to visit daily in the homes of the humbler classes, in order, principally, to ensure therein a certain measure of cleanliness. They also advise the mothers in matters of ventilation and clothing, and report upon any evidences they find of infectious disease, overcrowding, nuisance, or verminous conditions. We will now be able to extend the usefulness of their services in the direction of infant dietary, and be able, through them, not only to urge both carefulness and cleanliness, but also to advise all mothers who are unable, from various causes, to suckle their own infants, where to obtain milk which will be quite suitable for them. Cards and explanatory leaflets will be left in their homes, and if necessary demonstrations will be given to the mothers with regard to

the proper use of the sterilized milk. Amongst the class where we want our bottles to go there is much coming and going, and I am hopeful that each labelled Corporation bottle will be a missionary of health, which will give direct refreshing and stimulating draughts of life's nectar, so that the massacre of the innocents may be stayed.

We have good reason to hope that what has been found so successful in the district of Salford known as "Green Gate" in reducing the infantile mortality there in 1900 from 224 per 1,000 births, to 178 per 1,000 in two years, will be equally successful in Glasgow; and if successful, I have no doubt that this municipality will not hesitate to provide, in each of the larger areas of the city, a similar depot where such milk will be obtained.

I might mention here that the Corporation intend to sell their modified and sterilized milk at a low cost to all those who have dairies in the city, in order that they may also be utilised for the purpose of bringing about its extensive recognition and use, and the price to the mother is to be fixed at 2d., 2½d., and 3d. for a 24 hours supply.

Should these proceedings and attempts to reduce our infant mortality not be successful, it may become necessary to consider seriously the advisability of obtaining stringent powers in order to prevent mothers, for a certain period prior and antecedent to confinement, attending to any other duties but those of looking after their homes and their infants; and municipalities themselves may have to go further than preparing and distributing suitable milk, by setting up, in all working-class districts, establishments under matrons, to which neglected and improperly cared-for babies may be compulsorily taken, fed, and cared for, with power to charge the cost against the parents or guardians.

But the municipal preparation and sale of infants' milk may safely be tried in the first instance, backed up, as it assuredly ought to be, by the domiciliary visits of lady inspectors. If it does not do all the good we expect, we know it will, at any rate, preserve many infants at present irretrievably lost through mal-nutrition; and mal-nutrition not alone caused by milk in wrong proportion of natural ingredients, but by milk poisoned by being placed in unclean vessels and kept in squalid and poisonous atmosphere, as well as by preservatives, such as are sold all over the country to farmers, dairymen, and others, viz., boric and boracic acids, formalin, salicylic acid, and other so-called milk anti-ferments. I fear the use of these substances in warm weather is more common than we suppose, during which there is every incentive given to the producer to sophisticate his milk in this way, in order to palm off his stale milk upon the unsuspecting consumers. It is, to my mind, a matter of surprise and

regret that the Government, notwithstanding its careful and exhaustive investigation into the whole question of the uses and abuses of these preservatives—and especially in the knowledge of the value of the pasteurising or sterilising processes—has, up to the present, done nothing to forbid their use in connection with our milk-supply, in the very preservation of which there is so much to be done to prevent it becoming putrescent in a few hours' time, so that what was meant for the food of the infant in many cases becomes its poison.

Let us now turn, and that very briefly, to a consideration of what municipalities have done, and might do, for their populations at the close of life. In looking over the replies received from the foreign cities communicated with on the subject, one is at once struck by the fact that a large proportion of them appear to have given more consideration to the necessity of provision for the dead than for those who are alive.

In Glasgow we have hitherto done nothing towards the establishment of municipal cemeteries, although the question has, for a considerable time, been under special consideration by a committee of the Corporation.

Most of our larger and growing towns have their burial grounds in the hands of private interest. By the rapid growth of cities these are now, for the most part, situated in districts surrounded, more or less, by the population. Several of these burial-grounds in Glasgow have long since ceased to be used for burial, owing to the fact that as they became filled up they constituted a menace to the public health. Others of later date sprang up on the environs of the city, but these in turn are now also being surrounded, and as the city extends north and south, east and west, will eventually find themselves (say, within the next twenty or thirty years) equally in the centre of rapidly increasing dwellings. Moreover, the cost of burial to the humbler classes must always be a matter of serious import. Even the humbler citizen has a proper desire to possess for himself and his family what is known as a "private lair," which he can feel assured will be consecrated entirely to his own use and prevent him having a pauper's funeral. A single lair is not fitted, under the new regulations, to contain more than four coffins of ordinary size at the most; and even this costs in Glasgow from £2 10s. to £3 10s., which, together with the funeral expenses, imposes a considerable drain upon a poor man's resources.

There are many among us who are not quite satisfied that the provision of ground, wherein all at the end have to be laid, is a matter which can be considered to be fairly suited for the acquirement of profit; but, leaving this consideration on one side, there is the other and larger consideration that such grounds, in private hands, are always liable to the

abuse of over-burial. In this country this subject has not yet obtained the practical recognition which appears to have been given to it abroad; and if you will bear with me I will, very shortly, give you a synopsis of what has been done in this connection there.

In Copenhagen there are municipal burying-grounds extending to 275 acres, the lowest charge for a lair being 16s. 6d. In addition to this, poor people of the city obtain their ground free, and this is not considered against them as poor relief.

Hamburg has a large and beautifully laid out cemetery about three miles from the town, some 321 acres in extent. A private lair giving rights for twenty-five years costs 10s.

The municipality of Warsaw own three cemeteries, extending to 332 acres, in which lairs can be obtained for £1 5s. 5d. Paupers are buried there at the expense of the municipality.

In Odessa (Russia) all the public burial-grounds are the property of the municipality. They are five in number, and cover an area of 450 acres. What are known as "rotation graves" are given free to the poor.

In Palermo (Italy) the cemeteries are now a municipal monopoly, as also are the funerals.

Barcelona has seven municipal cemeteries, extending to about 95 acres, the cheapest lair being about £2.

Lyons has three municipal cemeteries, extending to 79½ acres, in which all poor persons have free burial.

The municipality of Lille possesses two cemeteries, 92½ acres in extent, interments in which are free. Special portions of ground, however, are sold to those who apply at a rate of 12 francs per square meter (equal to 29s.) for a concession of fifteen years.

Munich has fourteen municipal cemeteries, the price of the cheapest lair being 25s. for twenty-five years.

Turin has sixteen cemeteries owned by the municipality, and extending to 75 acres or thereby.

In Oporto the municipality possesses two public cemeteries, extending to 42 acres. The cheapest lair is £1 15s. 6d.

Seville possesses one municipal cemetery, 48 acres in extent. The cheapest lair is 19s. 9d.

In Vienna there is one large public cemetery and twenty small ones, which have become the property of the city on union with certain suburban districts. The total area extends to 629 acres. A lair here can be had for 5s.

Buda-Pesth possesses ten municipal cemeteries, 45 acres in extent. The cheapest lair is £1.

The City of Berlin possesses a municipal cemetery of 62½ acres, in which a lair can be obtained for 8s.

Amsterdam has two municipal cemeteries, 55 acres in extent, in which 8s. 3d. is charged for one interment, but no permanent occupation of the lair is given for this price. The cheapest private lair costs £3 6s. 8d.

Breslau possesses three cemeteries, 206 acres in extent, the price of a lair being 4s. 11d.

Gothenburg has a municipal cemetery of 133 acres, the price of the lair being £2 4s. 5d.

Lisbon has six municipal cemeteries, about 70 acres in extent, the cheapest lair being 7s. for a period of five years.

The City of Moscow possesses eight town-cemeteries, under the management of the ecclesiastical authorities, their area being 399 acres. Private graves cost 20s. 10d., but a poor person may be interred therein at the cost of 1s.

Buenos Ayres has two municipal cemeteries, 194 acres in extent. A charge of 15s. 6d. is made per lair for five years.

In Frankfort-on-the-Main there are four municipal cemeteries, extending to 82 acres. The cheapest private lair is 12s., and the lairs all revert to the town in twenty years.

Paris possesses twenty-two cemeteries, those within the city extending to 210 acres, and those without the city to 541 acres. The most important of these is the famous *Père-la-Chaise*, which has now become so proximate to the population that the municipality have determined to remove every body within it and all the tombstones, at the public expense, to a more suitable site in the environments of the city. No common graves are allowed in Paris in any cemetery within the city precincts, and a concession of ground for five years costs 50 francs, or £1 19s. 7d.

The municipality of Marseilles possesses fourteen cemeteries; the town or principal cemetery covers about 110 acres, and the others are of various dimensions, not given. In the town cemetery the cost of a lair is high, the cheapest being £4 18s.; but the lairs in the suburban cemeteries are cheaper, amounting to about 80 francs, or £3 3s. 4d. The concession is for fifteen years.

In America the Cities of New York, Brooklyn, Boston, Washington, San Francisco, and Philadelphia all possess municipal cemeteries,

but I need not weary you by detailing their extent and the cost per lair.

I have gone into detail in connection with these foreign towns to show you that there they consider the question of burial is quite a right and proper thing for the municipality to take in hand.

In our country I find there are 55 municipalities in England, five in Scotland, and one in Ireland which own cemeteries; and we have been informed by Mr. Lindsay, our police clerk, that there exist sufficient legal powers in the Burial Grounds (Scotland) Act, 1855, to enable any Corporation to acquire land for this purpose, and also to purchase existing cemeteries from Companies now owning them. Municipalities, therefore, have plenty of precedent, and also apparently sufficient legal power to make it their business to see that their citizens may be put in possession of a grave at the cheapest rate consistent with economy; and the question for sanitarians to consider is: Is there any material advantage to be gained to the public health from their possession and maintenance by a Corporation? This is really the only point which, as a meeting of professed sanitarians, you are called upon to consider.

I have already indicated, in passing, the risks that may accrue to public health in growing communities from (*a*) the acquirement by private companies of improper sites for this purpose, and (*b*) the risks which more or less always attend the burial of bodies by those, or the servants of those, whose interest it is to make a profit out of their business. Let us consider how far the elimination of these two factors would be attained under municipal possession and control.

In considering, firstly, the acquirement of ground for this purpose by a municipality, we are compelled, I think, to admit that private interest would compare unfavourably. The "popularity" of a cemetery—if I may use the term—will, no doubt, to some extent, be regulated by its distance from the population it is designed to serve, and, of course, on its popularity will, to a large extent, depend its power of producing profit or sufficient interest to entice private capital; hence one of the main considerations to a private company would be the securing of a suitable site as near as possible to the centre of a city. This consideration would not weigh with a corporation, whose interest is not profit, but the safeguarding, not only for the present but also for the future, of the health of the people. They would therefore seek, in my judgment, to secure suitable sites as far removed as possible from the centre of the city; and, in the exercise of the powers they possess, would doubtless take means to prevent the encroachment of dwelling-houses upon the immediate environs of the cemetery.

Under *(b)* the constant tendency, notwithstanding the regulations which have been laid down for the interment of human remains by private companies, is to dispose of their ground to the best financial advantage, and graves have been discovered in these private cemeteries filled with coffins with little or no earth between them, and with insufficient earth from the topmost coffin to the surface to thoroughly deodorise the emanations which may arise from the remains beneath. It would take an army of inspectors to be present at all the burials in privately-owned cemeteries in order to exercise a sufficient check upon this tendency, and hence a municipality has no sufficient guarantee that their regulations are, in all respects, properly adhered to. Under municipal ownership and control this danger would be entirely eliminated, as there would be no inducement to any person having the management or control to do otherwise than bury in every case strictly in accordance with the rules.

Thus, under both counts, municipal ownership and control seem to have a manifest advantage over those of private companies. It is not sufficient to urge that there has been no evidence of danger to the public health from any of the privately owned cemeteries. I apprehend that the danger from these places is very subtle in its nature. When one comes to consider the mass of putrefaction which must be going on continuously in burial-grounds, and the emanations which, either for want of sufficient earth, or especially for want of sufficient herbage over the graves, may be wafted unperceived over and among the population, it is not difficult to appreciate the danger. In any case, I am inclined to come to the conclusion that, in all cities where there is a large poor and labouring population, and where infectious diseases of one kind and another are constantly in evidence, the safest policy, as well as the most economical, is for the municipality to possess its own cemeteries.

I think I have now at sufficient length given you my views upon these two aspects of city life. There are, of course, other problems awaiting our attention and solution, but I have refrained from indicating them, first, because of want of time, and second, because the two I have referred to—and especially the first one—lie very close to my heart. In the multitude of papers and addresses to be given at this Congress, I have no doubt both of these subjects will be more suitably handled than I have been able to handle them, but I can only assure you that I have done what I could to bring them before you at this stage of the proceedings, in order that they may be so pondered by some of you as to enable you to contribute, in some of the other Sectional Meetings, to any discussions which may arise bearing upon them.

CONGRESS AT GLASGOW.

CONFERENCE ON INDUSTRIAL HYGIENE.

ADDRESS

By Councillor JAMES STEELE, J.P.,

Vice-Chairman of Committee on Health, Glasgow.

PRESIDENT OF THE CONFERENCE.

IN opening this Conference of those interested in the vast and all-important subject of industrial hygiene, I intend to confine myself to the expression of a few thoughts which cannot fail to strike one who lives and moves in such a city as Glasgow. The old motto of Glasgow is: "Let Glasgow flourish by the preaching of the Word"; but the axiom approved of her citizens is that of the wise man: "The hand of the diligent maketh rich." The axiom might quite truthfully be inverted into: "The desire for riches maketh the hand diligent." The great majority of the people never will be rich, and at the beginning of this century we seem to be more than ever confronted with the problem of how to enable the great mass of our citizens to be, not rich, but fairly capable to sustain themselves and their families in healthy life. It is the merest commonplace to observe that the advancement of civilisation creates wants and desires which only serve to increase the difficulty of obtaining a moderate competency. The increasing intensity of competition, coupled with the difficulties of making home agriculture a paying industry, has aroused general interest. Each succeeding census is exhibiting a continued depopulation of the rural parts of the country, and the swelling of already crowded cities. The evil is recognised, but its removal is still, I fear, far from accomplishment. Nay, this crowding of country people into the towns in search of employment continues persistently, despite the fact that, of all employments, that of the agriculturist is far and away

the healthiest. Dr. Tatham, of the Registrar-General's Department, in London, has shown that death-rates of agriculturists, not only from all causes, but also from respiratory and circulatory diseases, are much lower than those of almost any industrial pursuit or calling in a city or elsewhere. I give you a few instances. He puts the general mortality figure of agriculturists at 602, whereas the comparative figures for certain occupations considered fairly healthy, are as follows: bookbinders, 1,060; printers, 1,096; hatters, 1,109; hairdressers, 1,099; tailors, 989; drapers, 1,014; and shoemakers, 920.

But when we come to the comparative mortality figures of those industries from phthisis and diseases of the respiratory organs, the difference is even more marked. If we consider the ratio of agricultural mortality at 100 from this class of diseases, he shows that for bookbinders it is 246; for printers, 244; for hatters, 231; for hairdressers, 221; for tailors, 211; for drapers, 200; and for shoemakers, 198; in all but the last more than double that of the men employed on the land and working in the open air in the country.

But when we come to consider the mortality of the more unhealthy industries, such as potters, cutlers, filemakers, glassmakers, copperworkers, iron and steel workers, and such like, we find the figures for general mortality ranging from 1,300 to 1,700, as against 602 for agriculturists; and in the mortality from lung diseases, figures ranging from 300 to 450 in place of 100.

When one considers the import of these figures, and at the same time remembers the conditions surrounding many of our agricultural labourers—conditions stated by the report of the last Royal Commission that considered the subject, to be "physically and morally unwholesome and repulsive"—it is seen that the whole subject of industrial hygiene is one which, instead of occupying the attention of this Congress for one day, might well have been earnestly pondered and discussed during its whole sitting.

The term Industrial Hygiene presupposes industrial disease; and we all know that there is almost no occupation or trade that does not, in some way or other, operate against the health and vitality of those who follow it. Masons and quarrymen contract phthisis; potters, painters, and plumbers, plumbism and colic; woolsorters, anthrax; lucifer-match makers, phossy jaw; coachmen and cabmen, rheumatism; and all through the gamut of industry one can detect the wail of a physical suffering which is more or less peculiar to each.

In connection with many of them there is no oversight by the State or by the sanitary authority. The mason may hew the sand into his eyes

and lungs, and the plumber may inhale lead and zinc fumes to his heart's content without let or hindrance from anyone. Although perfectly well recognised as dangerous to life, if reasonable precautions are not used, many of our more common industrial pursuits receive no legal recognition. In these the axiom seems to be, Man, protect thyself! There is not even an effort made to enlighten the ignorance of those who, when young, enter upon them, and it is only when disease has set in and a doctor is consulted that the victim may come to apprehend the consequences of his negligence of hygienic laws. On the other hand, there are occupations over which the State seeks to, and does, exercise a control. We have State regulation of what are known as the special dangerous trades, some of which I have referred to. There are the Alkali Works Acts, which control the manufacture of sulphate of soda, sulphate of potash, and all other works where copper ores are treated by common salt or other chlorides, by which any sulphate is formed or muriatic acid is evolved; and at present there is a Consolidation and Amending Bill before Parliament to further strengthen the hands of the Government inspectors, who, I may say in passing, are all too few in number to adequately perform the immense amount of useful work that lies to their hands all over the country. I daresay many of you will scarcely believe that, for the whole of Scotland, there is only one inspector appointed by the Crown to carry out the provisions of the Act, and that, besides his duty in this respect, he is expected to devote his attention to the requirements of the Rivers Pollution Acts. These Acts certainly provide the steam, but, for want of men, the machinery is practically at a standstill. Both of these Acts, and particularly the industries comprehended within the four corners of the Alkali Acts, demand not only constant watchfulness at all hours, but also carefully conducted chemical tests to ensure that the dangerous acids, fumes, vapours, and gases constantly evolved do not issue to the outer air in greater proportion than is laid down in their sections, even to the extent of one-fifth part of a grain in each cubic foot of air, smoke, or chimney gas escaping. Yet, so far as I know, no assistant is provided for the purpose to any alkali works inspector by the Government.

It is true that one of these sections of the Acts provides for additional assistance should any sanitary authority call for it, but only on the understanding that the demanding authority pay one-half of his salary, and that without having any say in his appointment, his duties, or his dismissal. It is not surprising that few sanitary authorities have made such a demand, however needful may be the case. So far as I can learn, only one in the kingdom has done so, viz., that of South Lancashire. When I tell you

that the first schedule of the Bill now being considered names 21 different kinds of chemical manufactories, requiring fairly constant supervision, you will be able to appreciate to some extent the parsimony of our governing authorities in their administration of this most important branch of industrial hygiene. I now pass from this to cast a brief glance at another branch of our subject, viz., the so-called unwholesome trades. Those are specified in the Public Health Acts, and comprise such factories as blood-boilers and driers, gut-scrapers, fellmongers, glue-makers and soap-boilers, tallow-melters, bone-boilers, tripe-cleaners, manure manufacturers, and such like. Unlike the 21 different kinds of factories under the Alkali Acts, these are placed under the supervision and control of local sanitary authorities, who are empowered to license or withhold license from those who carry them on, and make by-laws for the conduct and structural requirements of such businesses.

The nuisances likely to be created in these works, for the most part consist of offensive organic vapours evolved from the treatment of decomposing animal substances by fire or steam heat. There are 57 such works in this city of Glasgow.

Although the vapours arising from the processes carried on therein are more distinctly offensive to the nostrils than those emitted from the alkali works, I apprehend they are not so dangerous, neither to those employed in such places nor to the public. Notwithstanding this, being constantly under the eye of a large staff of inspectors employed by local authorities, they receive a share of attention out of all proportion to that given to the alkali works. If any of them cause the emission of noxious or offensive fumes, the citizen is not slow to apprise the local authority of the fact, and steps can at once be taken to investigate the cause and prevent its continuance. There is little or no evidence, that I am aware of, to show that such businesses are specially inimical to the health of the workers. The terrible diseases which arise among those engaged in the alkali class of industries are absent from the employees in the unwholesome trades, probably because of the fact that in the vast majority of them, dust is conspicuous by its absence, and the corrosive action of acids and alkalies is absent except in rare instances.

I have already shown you the excessive mortality of several of the dust-producing trades, and we have it on the highest authority that, whether the dust be of an absolutely poisonous nature or merely acts on the skin or organs of the body in a mechanical way, it invariably plays the prominent part in occupational or industrial diseases. Yet the works I am now speaking of, because they tend to spread abroad in the atmosphere

vapours which are obviously offensive and liable, in sensitive persons, to produce nausea and even vomiting, bulk largely in the public eye; although, as a matter of fact, in the eye of science and experience alike, they are not so pronouncedly harmful as many of the industries to which less, or even no attention is given. It is not to be understood by this that I am inclined in any way to deprecate the assiduous attention and inspection given to this class of trade. My object is rather to concentrate attention on those that are dust-producing, and ask for them, and the workers in them, as great a consideration and protection as are afforded by the Public Health Acts with regard to the offensive trades. To my mind the conclusion is irresistible that, in this regard, we are straining at gnats and swallowing camels.

Then, lastly, we have all the industries to which the Factory and Workshop Act applies. Their name is legion, and the workers in them, old and young, male and female, form the great mass of our industrial population. The Factory Act seeks not only to protect the workers (women and young persons) from the avarice of the employers in the regulation of the hours of labour, but also makes certain stipulations as to the adequate ventilation, temperature, dryness of air and floors, sanitary conveniences, and other sanitary conditions. There are also, as you know, provisions for safety against fire, and safeguards against accidents from machinery. The Act is very minute and comprehensive, but in several particulars it could well afford to be more so. I have referred to the special danger of dusty occupations. There is almost an equal danger in the factories and workshops under this Act in the continual respiration of vitiated or pre-breathed air.

In 1902 I observed in the minutes of our health committee a report prepared by our chief sanitary inspector regarding the sanitary condition of 570 of our workshops and work-places. In 37 of these, samples of the air breathed by the employees were taken, and submitted to our corporation chemist. The natures of the trades were various: tailors, costumiers, jewellers, calenderers, dressmakers, bootmakers, restaurateurs, underclothing manufacturers, fishing-tackle makers, japanners, milliners, etc. The average quality of the air in the workrooms of the eight tailors was very bad, showing 28 parts per 10,000 volumes of carbonic acid. In certain instances it rose as high as 33, 36, 39, up to 46 parts per 10,000; while only in four out of the 37 did it come under 10 parts per 10,000, which, by most experts, is considered the maximum of impurity permissible. What is the cause of this state of matters? Is it not largely due to the fact that the standard of working air space prescribed by the

Factory Act is too low to render natural ventilation possible? By our local Acts, no citizen is allowed to sleep in any dwelling-house under 400 cubic feet of free air space, while under the Factory Act he is allowed to work in 250. Surely there is an anomaly here? It seems clearly to be common sense (whatever science may tell us) that a working animal requires more fresh air in labour than when asleep. Yet in our legislation we have conditions for the working out of this principle reversed.

The Act makes it compulsory, where necessary, that the occupier of a manufactory who employs machinery shall provide suitable mechanical ventilation, but there is no such power given with respect to workshops and work places without machinery. I look upon this as a grave defect in our Workshops Act. In these days of electrical energy, brought, so to speak, within the reach of all, surely the legislature, in seeking to protect the industrial population, might have armed local authorities who have put down electrical plant with the power to demand the installation of fans in such badly-ventilated workrooms as I have referred to. They might have gone further, and specified clearly in the Act the amount of carbonic acid pollution permissible as a maximum in all city workrooms.

Such are a few of the thoughts that have occurred to me in connexion with industrial hygiene. Doubtless, in the course of our discussions to-day, we will have many things before us that will bring us nearer a proper understanding of this all-important subject.

I am satisfied if I have succeeded to any degree by these general remarks in arousing your interest in the work that lies before us.

CONGRESS AT GLASGOW.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

ADDRESS

By SIR CHARLES A. CAMERON, C.B., M.D., F.R.C.P.I., F.R.C.S.I., D.P.H.,

Professor of Hygiene and Chemistry, R.C.S.I.; Medical Superintendent Officer of Health for Dublin.

(MEMBER.)

PRESIDENT OF THE CONFERENCE.

THE STATUS OF THE PUBLIC HEALTH MEDICAL SERVICE IN IRELAND.

IN opening the proceedings of a Conference of Medical Officers of Health, a President's address should perhaps be of a general nature, referring to the United Kingdom, and not confined to a portion of it. I have therefore to apologise for limiting my observations to Ireland. I venture, however, to hope that a brief account of the status of the public health medical service in that country may not prove wholly uninteresting to this Conference.

In 1866, the Corporation of Dublin appointed a medical officer of health under the provisions of the Sanitary Act, 1860. No other medical officer of health existed that year in Ireland or for several years following. The appointments of such officers was optional until 1874. In that and following years a large number of consulting sanitary officers were appointed by the sanitary authorities of the larger towns, and by the Boards of Guardians of the Poor Law Unions, the sanitary authorities for the rural districts.

The Public Health (Ireland) Act of 1874 created two classes of medical health officers, namely, medical officers of health and medical

superintendent officers of health. The Local Government Board constituted a third class, consulting sanitary officers. The Poor Law (dispensary) medical officers became *ex officio* medical officers of health. The consulting sanitary officers might or might not be Poor Law medical officers. They were to be elected by the sanitary authorities, subject to the approval of the Local Government Board. For some time no medical superintendent officer of health was appointed.

In 1878, the Act of 1874 was wholly repealed, and a new one, embodying, with additions, about twenty sanitary statutes, was enacted. It also provided that the Poor Law medical officers should be *ex officio* medical officers of health.

In 1874, the Local Government Board issued a sealed order to the Corporation of Dublin directing them to appoint a "medical officer of health" and a "consulting sanitary officer." I was appointed to the former office, and Dr. Mapother, who had borne that title since 1866, became consulting sanitary officer.

On the passing of the Public Health Act of 1878, the Corporation were directed to appoint a "medical superintendent officer of health" and an "executive officer of health." Dr. Mapother was elected to the former office, whilst retaining the position of consulting sanitary officer, and the secretary of the public health committee had his designation changed to executive sanitary officer. Dr. Mapother resigned his position as superintendent medical officer of health, in 1879, and I succeeded him.

In 1882, on the death of the executive sanitary officer, his duties were added to mine, and I was given the whole charge of the sanitary department. Finally Dr. Mapother received a pension, and the position of consulting sanitary officer for Dublin was terminated. Although I am now medical and executive officer of health and public analyst for Dublin, I think it extremely improbable that such a combination of offices will continue after my time. The work of sanitary authorities is yearly increasing in extent and variety, and division of official labour is becoming more and more desirable in the larger sanitary districts.

The consulting sanitary officers appointed by the Boards of Guardians were, for by far the greater number, the medical officers of the workhouse infirmaries. In some cases the *ex officio* health officers and non-union officers were also consulting sanitary officers. Their maximal salary was £50 a year; in only a very few instances some were paid by fees, but the majority received salaries of from £5 to £20 per annum. The Local Government Board of Ireland have recently decided that vacancies in these offices are not to be filled up.

The duties of medical superintendent officers of health as defined by the Local Government Board differ only in one important respect from those of the consulting sanitary officer, namely, that they include the supervision of the work of the *ex officio* officers. Perhaps in process of time the remaining consultants will become medical superintendent officers of health. The following is an up-to-date list of county boroughs and urban and rural districts in which medical superintendent officers of health are appointed:—

District	Salary	District	Salary
Dublin County Borough* ...	£1000	New Ross Urban District ...	£15
Belfast County Borough ...	500	Rathmines and Rathgar Urban District	50
Cork County Borough	300	Tralee Urban District	25
Limerick County Borough .	100	Castlereagh (Belfast No. 2) Rural District...............	20
Londonderry County Boro.	350	Belfast Rural District	12
Waterford County Borough	60	Castlebar Rural District (vacant since March, 1903) .	15
Ballinasloe Urban District...	15	Glennamaddy Rural District	10
Bray Urban District (vacant since September, 1903) ...	30	Dublin, North, Rural District	20
Drogheda Urban District ...	40		
Kingstown Urban District...	100		
Lurgan Urban District	25		

By the Irish Local Government Act of 1898, the Boards of Guardians ceased to be sanitary authorities. The districts under their control were formed into rural districts, and placed under the government of "Councils," who have the power of appointing medical superintendent officers of health. They have to pay the salaries of the *ex officio* officers of health.

On the passing of the Public Health Act in 1874 the Dublin Corporation were requested by the Local Government Board to fix the salaries of the *ex officio* medical officers of health in the city dispensary districts. The sum fixed for each was £25 a year. As there were fifteen dispensary physicians the total sum given to them was £375, and subsequently on the appointment of another additional officer, £400 a year. There are now no fewer than twenty of these officers in the city of Dublin; population 292,000. A curious circumstance in this case was the fixing of salaries by an authority who did not pay them, for until 1898 the city district officers were paid by the Boards of Guardians. Agreeably to the provisions of the Public Health Act of 1874, the Treasury paid one half of the salaries of medical officers of health and sanitary inspectors, who were, in conse-

* Medical Superintendent Officer of Health, Executive Sanitary Officer and Public Analyst. Allowed £120 a year for laboratory expenses, the use of a laboratory, and provided with some assistants.

quence of the passing of the Public Health Act, appointed; the Treasury also determined to give one half of any increases of salaries of existing health officers. This arrangement was most unfair to Dublin, which was in effect punished instead of being rewarded, for having appointed a large sanitary staff when they were not compelled by law to do so. On the other hand, the towns in which no sanitary staffs, or totally insufficient ones, existed, forthwith appointed their sanitary officers, and received from the Treasury, through the Local Government Board, a moiety of their salaries.

It is to the credit of the Irish Local Government Board that on the passing of the Local Government (Ireland) Act, they rectified the injustice under which Dublin had suffered for more than twenty years. The Board have now the disposal of the grant to sanitary authorities, and they pay half the salaries of all the public health officers who were in existence in 1874, or the persons who had succeeded them. The sum received by Dublin for the year 1903 was £2,091.

There is no reference to the subject of a retiring allowance to medical officers of health in the Public Health Act. In the case of an officer giving his whole time to the service of his authority, it would seem likely that, as in the case of other municipal whole-time officers, he would be entitled to a pension.

As I am not a whole-time officer, the Corporation of Dublin was so good as to get power to grant a pension to their medical officer of health. The 93rd section of the Dublin Corporation Act, 1890 (53 & 54 V., c. ccxlvi.) enacts that, with the approval of the Local Government Board, they may grant a retiring allowance not exceeding two-thirds of his salary to "any medical officer of health of the Corporation."

A similar section was passed subsequently in an Act promoted by the Corporation of Belfast.

When the Dublin Corporation Act was passed, the payment of the district medical officers of health was made out of the Poor Rate. A question has now arisen: Does section 93 of the Corporation Act apply to them as well as to the medical superintendent officer of health? Two district medical officers of health, having resigned, applied for pensions to the Corporation. The law agent of that body considered that the Corporation had no power to grant such pensions, as they (the district officers) were not contemplated when the Corporation Act of 1890 was obtained, and as no provision for pensions was made in the Act of 1878.

The Irish Medical Association, therefore, submitted a case to Mr. Matheson, an eminent King's Counsel. His opinion is too long to be read

to the Conference, but I give it in the form of a note (p. 317). As regards the Local Government Board, their views seem to be rather in favour of those of the Corporation's law-adviser.

So long as the payment of the medical officers of health was in the hands of the Boards of Guardians, it was usual to take into consideration, in determining the amount of their retiring allowances, their income from all official sources, vaccination and registration of births and deaths fees, and public health salary. In future the Boards will, in all probability, take no account of their income as sanitary officers accruing after 1898. It is only common justice to the medical officers of health that power should be given to the sanitary authorities who have succeeded the Boards of Guardians to grant retiring allowances to the medical officers of health. Indeed, it is to be hoped that at no distant date the Poor Law officers and medical officers of health will be placed as regards pensions in the same position as civil servants. At present the granting of pensions is wholly optional with the local authorities.

The *ex officio* medical officers of health are dissatisfied with the smallness of the salaries which they receive: for all Ireland they average £18 6s. a year. The Corporation of Dublin proposed in 1901 to increase their officers' salaries from £25 to £40 per annum, but the proposal was not approved of by the Local Government Board.

No inconsiderable proportion of the *ex officio* officers would prefer not to have any sanitary duties imposed upon them, believing that they prejudice their medical practice. In visiting their patients nuisances come under their observation, to which they feel obliged to direct the attention of the sanitary authority. Amongst the poorer, and to some extent the middle, classes, there is often an objection to have their dwellings disinfected after the occurrence of infectious disease in them. They may think it unnecessary or may dislike the inconvenience it causes them. In many cases the dispensary physician is not called in, and some other medical man's advice is sought for in the hope that he would not insist on disinfection being performed by the sanitary authority.

Another reason why the dispensary physician is often ignored, is due to the objection some persons have to go to a fever hospital, or to allow persons in their charge (except employees) to be removed to it. As the medical officer would in all probability insist on the removal to hospital of a fever patient unprovided with proper accommodation, or who was likely to endanger the health of persons residing in the same house, a physician less likely to be so uncompromising is sent for.

It has been suggested that in the next Public Health Act for Ireland

ex officio medical officers of health should be abolished. A Commission appointed in 1900 by the Lord Lieutenant to inquire into the causes of the high death-rate in Dublin, recommended the abolition of *ex officio* officers of health in Dublin, and the substitution therefore of an assistant whole-time officer. I am inclined to think the recommendation a good one, if it could be carried out without inflicting pecuniary loss on the present officers. As regards Ireland at large, it would be difficult, or impossible, in many a district to get any medical man other than the Poor Law officer, for the simple reason that he is the only medical man in it. Instead of abolishing the *ex officio* officers, it would be better to institute medical officers of health in connection with the County Councils. The appointments should be made compulsory, and the officers should give their whole time to their duties. They should have a small number of sanitary inspectors, with jurisdiction extending over the whole county. Rural sanitation is sadly neglected in Ireland, and practically there are no whole-time sanitary sub-officers in the rural districts. The relieving officer is generally also the sanitary sub-officer, with a trifling salary as such.

An energetic medical superintendent officer of health would find ample and useful employment in every county in Ireland. Much of the milk supplied to towns comes from farms the hygiene of which is very insufficiently enquired into. Nuisances of all kinds are to be found in the country as well as in the town. Many of the former cannot be dealt with by the local medical officer of health; he cannot get his petty local Board to deal with them, or perhaps he finds it incompatible with his interests to take too energetic action as regards them. Those responsible for an insanitary state of things are his patients, or the members of his Board of Guardians. It is not worth his paltry salary of £10 or £15 a year to offend them. Notwithstanding the unpleasant position in which hygienic activity places the rural health officer, many of them do their best to remedy insanitary evils, and suffer for their activity and zeal.

A county medical officer and two or three sanitary inspectors, independent of local influences, irremovable except for misconduct, and entitled to a pension, would do more good than can ever be accomplished by the existing sanitary organizations. The nature of the duties of medical officers of health and medical superintendent officers of health are set out in a Sanitary Order of the Local Government Board to the County Boroughs of Dublin and Belfast.

DR. SPEEDY'S CASE.

Copy of Extract from Opinion of Mr. Matheson, K.C.

I AM OF OPINION that the Corporation have power to superannuate Dr. Speedy under the powers hereinafter referred to. The position of Medical Officers of Health appears to have been created by Section 11 of the Public Health Act, 1878, by virtue of which the Medical Officers of every Dispensary District became Sanitary Officer under the Title of Medical Officer of Health—at such additional salary as the Sanitary Authority with the approval of the Local Government Board should determine. Until the passing of the Local Government Act, 1898, Dr. Speedy was, as I understand, the Officer solely of the North Dublin Guardians who were the Sanitary Authority of his District. Assuming this to be so, there is no section in the Local Government Act expressly transferring him to the Corporation, as Section 115 (1) which carries out the general transfer of Existing Officers only deals with officers employed in that business and not in any other business of the former authority, but I think that he is impliedly transferred as the Corporation becomes under the Act (Sec. 22) Sanitary Authority, and Sec. 85, sub.-sec. (4) provides that the additional salary granted to the Medical Officer of a Dispensary District under Sec. 11 of the Public Health Act, 1878, by reason of his being Medical Officer of Health of the Sanitary District shall be paid by the Council of that Sanitary District. Since the Local Government Act came into force, therefore, he appears to have been a Medical Officer of Health of the Corporation.

Three possible ways in which he might claim superannuation could be suggested:—

(1) Under Section 118 of the Local Government Act, 1898.

(2) Under Section 93 of the Corporation Act, 1890.

(3) Under the Local Officers Superannuation Act, 1869, as amended by the Local Government Act, 1902, Section 10.

Section 118 (1) provides that every existing officer who is transferred to any County or District Council or is an officer of any Board of Guardians, and would if he retired on the appointed day be qualified for superannuation allowance—shall be entitled on resigning to superannuation according to the Civil Service scale, and by sub-section (2) qualified for superannuation means qualified as to age and length of service and devotion of his whole time to the service—except as regards a Medical Officer to whom the Medical Officers Superannuation Act, 1869, applies. Dr. Speedy would not be entitled to superannuation under this Section as he did not devote his whole time to the service, unless the exception of a Medical Officer entitled to superannuation under the Act of 1869 would extend to his position of Medical Officer of Health. If he had not been transferred I think that the Guardians could on his resignation have superannuated him in respect of his position of Medical Officer of Health as well as his other positions, but this would be by virtue of the Act of 1869 and the Public Health Act of 1896, Section 6. Being on the appointed day qualified for superannuation as an officer of the Guardians I am inclined to think that the effect of Section 118 is to make it a right, and that his transfer did not destroy that position but that his right to superannuation was transferred to the Corporation. It is, however, very doubtful and arguable.

Section 93 of the Dublin Corporation Act, 1890, in terms empowers the Corporation on the resignation of a Medical Officer of Health of the Corporation with the sanction of the Local Government Board, to superannuate him. Of course, at the date of the passing of that Act the cases of Officers like Dr. Speedy

were not in contemplation, but the terms of the Act expressly apply to him, and I think that there is power under it to superannuate him. The difficulty, however, would be as to the basis of superannuation, for he was only Medical Officer of Health for a very short time, and there is a serious question whether if superannuation were to be given under this Section his services under the Guardians could be taken into account. This depends upon whether the provision in Section 115 sub-section 3 of the Local Government Act, 1898, can be applied to superannuation of an officer under the Corporation Act of 1890, as to which see below.

The third possible method is under the Local Officers Superannuation Act, 1869, as amended by the Local Government Act, 1902, Sec. 10.

This power, however, seems only to enable the Corporation to superannuate them in respect of their service under the Corporation, and would not enable the Corporation to award an allowance based on the 25 years' service of Dr. Speedy, 20 of which were not in their service, unless the provisions of Sect. 115, sub-sec. (3) of the Act of 1898 apply to such a case. There is a provision in Section 115, sub-section 3, of the Local Government Act, 1898, to the effect that "for the purpose of the enactments relating to superannuation the service of an existing officer of any authority before the transfer to a County or District Council shall be reckoned as service under that Council." If this were to be regarded as a general provision applicable to all existing officers who are expressly or indirectly by the effect of the Act transferred to a County Council, then it would, I think, apply to the powers of superannuation given under Section 93 of the Corporation Act, 1890, and by the Local Officers Superannuation Act, 1869. The provision, however, though very general in its terms, occurs in a sub-section of a section which transfers expressly certain existing officers of a limited class, namely, those who have been employed solely in the business of the authority from whom they are transferred—and it can fairly be contended that sub-section (3) deals only with the officers transferred by sub-section (1) which would not include Dr. Speedy. The words are, however, very wide, and I think that as there is no similar provision in relation to other Officers to whom the same principle must be applicable, the provision would be held to apply to all persons coming under the definition of existing officers and to all enactments relating to their superannuation.

On the whole, therefore, I am of opinion that in each of the three ways above mentioned there is power to superannuate Dr. Speedy for his services as Medical Officer, though as has been seen there are difficulties which may be raised in each case. Under the Local Officers Act, 1869, also the exercise of the power appears to be more optional than under the other powers.

SANITARY ORDER BY LOCAL GOVERNMENT BOARD.

14. The following shall be the duties of the Medical Superintendent Officers of Health in the County Boroughs of Dublin and Belfast:—

(1.) He shall inform himself respecting all influences affecting or threatening to affect injuriously the public health within the County Borough.

(2.) He shall inquire into and ascertain by such means as are at his disposal, the causes, origin, and distribution of diseases within the County Borough, and ascertain to what extent the same have depended on conditions capable of removal or mitigation.

(3.) He shall by inspection of the County Borough both systematically at certain periods, and at intervals as occasion may require, keep himself informed of the conditions injurious to health existing therein and regularly report the same to the Sanitary Authority.

(4.) He shall advise the Sanitary Authority or their Committees on all matters affecting the health of the County Borough, and on all sanitary points involved in the action of the Sanitary Authority, and in cases requiring it, he shall certify for the guidance of the Sanitary Authority or of the Justices as to any matter in respect to which the Certificate of a Medical Officer of Health or a Medical Practitioner is required as the basis of or in aid of sanitary action.

(5.) He shall advise the Sanitary Authority on any question relating to health involved in the framing and subsequent working of such bye-laws and regulations as they may have power to make, and as to the desirability of the Sanitary Authority adopting any of the provisions of the Public Health Acts or any other Act applicable to Urban Sanitary Districts which it may be optional with the Sanitary Authority to put in force in the County Borough.

(6.) On receiving information of the outbreak of any infectious or epidemic disease of a dangerous character within the County Borough, he shall visit without delay the place where the outbreak has occurred, and inquire into the causes and circumstances of such outbreak, and in case he is not satisfied that all due precautions are being taken, he shall direct the persons competent to act as to the measures which may appear to him to be required to prevent the extension of the disease and take or direct to be taken such measures for the prevention of the spread of the disease as he is legally authorized to take or direct to be taken.

(7.) He shall attend all meetings of the Public Health Committee and advise them as regards the action to be taken in matters relating to sanitation, and he shall also attend all important sanitary prosecutions.

(8.) He shall direct or superintend the work of the Medical Officers of Health and Sanitary Sub-Officers, and on receiving information from such Officers that his intervention is required in consequence of the existence of any nuisance or other conditions injurious to health, or of any over-crowding in a house, he shall, as early as practicable, visit the place and take, or direct to be taken, such steps as he is legally authorized to take, or direct to be taken, and as the circumstances of the case may justify and require.

(9.) In any case in which it may appear to him to be necessary or advisable, or in which he shall be so directed by the Sanitary Authority, he shall himself inspect and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or milk, or any other article to which the provisions of the Public Health Acts in this behalf apply, exposed for sale or deposited for the purpose of sale or of preparation for sale, and intended for the food of man, which is deemed to be diseased, or unsound, or unwholesome, or unfit for the food of man; and if he finds that such animal or article is diseased, or unsound, or unwholesome, or unfit for the food of man, he shall give such directions as may be necessary for causing the same to be dealt with by a Justice according to the provisions of the Statutes applicable to the case.

(10.) He shall perform all the duties imposed upon him by any of the bye-laws and regulations of the Sanitary Authority, duly confirmed where

confirmation is legally required in respect of any matter affecting the public health, and touching which they are authorized to frame bye-laws and regulations.

(11.) He shall inquire into any offensive process or trade carried on within the County Borough, and report on the appropriate means for the prevention of any nuisance or injury to health therefrom.

(12.) He shall report in writing, monthly, or more frequently if required, to the Sanitary Authority, his proceedings and the measures which may require to be adopted for the improvement or protection of the public health in the County Borough. He shall in like manner report with respect to the sickness and mortality within the County Borough so far as he has been enabled to ascertain the same, and on the discharge of their duties by the Medical Officers of Health and Sanitary Sub-Officers of the County Borough.

(13.) He shall also make an annual report to the Sanitary Authority up to the end of December in each year, comprising a summary of the action taken or which he has advised the Sanitary Authority to take during the year for preventing the spread of disease, and an account of the sanitary state of the County Borough generally at the end of the year. The report shall also contain an account of the inquiries which he has made as to conditions injurious to health existing in the County Borough, and of the proceedings in which he has taken part or advised under any Statute so far as such proceedings relate to those conditions, and also on account of the supervision exercised by him or on his advice for sanitary purposes over places and houses that the Sanitary Authority have power to regulate, with the nature and results of any proceedings which may have been so required and taken in respect of the same during the year. The report shall also record the action taken by him or on his advice during the year in regard to offensive trades, to dairies, cowsheds, and milkshops, and to factories and workshops.

(14.) He shall give immediate information to Us of any outbreak of dangerous epidemic disease within the County Borough, and shall transmit to Us a copy of each annual report and of any special report.

(15.) He shall receive and take the necessary action upon the notices given under the Infectious Disease (Notification) Act, 1889, and in all action taken by the Sanitary Authority under the Infectious Disease (Notification) Act, 1889, and the Infectious Disease (Prevention) Act, 1890, he shall be substituted for the Medical Officer of the Dispensary District in accordance with the provisions of Section 18 of the Public Health (Ireland) Act, 1896.

(16.) When a Certificate has been received from a Medical Practitioner in terms of Section 3 (1) (b) of the Infectious Disease (Notification) Act, 1889, the Medical Superintendent Officer of Health shall instruct the Sanitary Sub-Officer to make the necessary inquiries, and to take such measures as are necessary for preventing the spread of the disease.

(17.) It shall be the duty of the Medical Superintendent Officer of Health to enter, or cause to be entered, both the Certificates and the Notices in a book to be provided by the Sanitary Authority and to be called the *Register of Notifications*, which shall be kept in the Office of the Sanitary Authority for that purpose.

(18.) The Medical Superintendent Officer of Health shall also keep any other books or forms in connexion with the Infectious Disease

(Notification) Act, 1899, which We or the Sanitary Authority may, from time to time, consider necessary.

(19.) Whenever We shall make arrangements for all or any of the purposes specified in Section 149 of the Public Health (Ireland) Act, 1878, and shall declare the regulations so made to be in force within any area comprising the whole or any part of the County Borough, he shall observe such regulations so far as the same relate to or concern his office.

(20.) He shall furnish to Us such returns of sickness and disease as shall from time to time be required from him.

(21.) In matters not specially provided for in this Order, he shall observe and execute all the lawful orders and directions of the Sanitary Authority and all the orders, directions, and instructions that We may hereafter make, issue, or give, applicable to his office.

15. The following shall be the duties of each of the Medical Officers of Health appointed in the County Boroughs of Dublin and Belfast:—

(1.) He shall inform himself respecting all influences affecting or threatening to affect injuriously the public health within his District.

(2.) He shall inquire into and ascertain, by such means as are at his disposal, the causes, origin, and distribution of diseases within his District, and ascertain to what extent the same have depended on conditions capable of removal or mitigation.

(3.) He shall, by inspection of his District both systematically at certain periods and at intervals as occasion may require, keep himself informed of the conditions injurious to health existing therein, and regularly report the same to the Sanitary Authority.

(4.) He shall advise the Sanitary Authority on all matters affecting the health of his District, and on all sanitary points involved in the action of the Sanitary Authority, and in cases requiring it he shall certify, for the guidance of the Sanitary Authority or of the Justices, as to any matter in respect of which the Certificate of a Medical Officer of Health or a Medical Practitioner is required as the basis of or in aid of sanitary action.

(5.) On receiving information of the occurrence of any case of infectious or epidemic disease of a dangerous character within his District, he shall visit the place without delay where the outbreak has occurred and inquire into the causes and circumstances of such outbreak, and report the same to the Medical Superintendent Officer of Health. In case he is not satisfied that all due precautions are being taken, he shall advise the persons competent to act as to the measures which may appear to him to be required to prevent the extension of the disease, and take or direct to be taken such measures for the prevention of the spread of the disease as he is legally authorized to take or direct to be taken. He shall also forward to Us without delay a report giving particulars as to (1) name, age, and address of patient, (2) nature of disease, (3) probable source of infection, and (4) action taken to prevent the spread of the disease; provided always that in the event of an infectious disease becoming epidemic it shall not be necessary for him to report to Us respecting each case as it arises if he has already informed Us of the prevalence of the disease.

(6.) He shall perform all the duties imposed upon him by any bye-laws and regulations of the Sanitary Authority, duly confirmed where confirmation is legally required, in respect to any matter affecting the public health and touching which they are authorized to frame bye-laws and regulations.

(7.) He shall inquire into any offensive process or trade carried on within his District, and report on the appropriate means for the prevention of any nuisance or injury to health therefrom.

(8.) He shall attend all such meetings of the Public Health Committee as they may direct, and shall assist in all proceedings in which his services may be required.

(9.) He shall from time to time report, in writing, to the Sanitary Authority his proceedings and the measures which he may require to be adopted for the improvement or protection of the public health in his District.

(10.) He shall keep a book or books, to be provided by the Sanitary Authority, in which he shall make an entry of his visits, and notes of his observations and instructions thereon, and also the date and nature of applications made to him, the date and result of the action taken thereon, and of any action taken on previous reports, and shall produce such book or books whenever required to do so by the Sanitary Authority.

(11.) Whenever We shall make regulations for all or any of the purposes specified in Section 149 of the Public Health (Ireland) Act, 1878, and shall declare the regulations so made to be in force within any area comprising the whole or any part of his District, he shall observe such regulations so far as the same relate to or concern his office.

(12.) He shall furnish Us with such returns of sickness and disease as shall from time to time be required from him.

(13.) In matters not specifically provided for in this Order, he shall observe and execute all the lawful orders and directions of the Sanitary Authority and all the orders, directions, and instructions that We may hereafter make, issue, or give, applicable to his office.

16. The following shall be the duties of each Executive Sanitary Officer of the County Boroughs of Dublin and Belfast:—

(1.) He shall attend all meetings of the Public Health Committee, and take their directions from time to time on the sanitary business of the County Borough, and on the reports of the Sanitary Officers and all proceedings arising thereon, and shall, so far as may be requisite, give instructions for the prompt and correct execution of all such orders and directions, and report on such execution or any neglect or failure therein which may come to his knowledge.

(2.) He shall report to the Public Health Committee at each meeting any failure on the part of the Sanitary Sub-Officers to comply with the provisions of Article 17 (10) of this Order, and any neglect by a Sanitary Officer to carry out the duties of his office as herein prescribed.

(3.) He shall keep a record of the proceedings of the Public Health Committee at their several meetings, and shall transmit a copy of such record to Us as soon after each meeting as practicable.

(4.) He shall report forthwith to the Medical Officer of Health the action taken by the Sanitary Authority on the reports submitted to them by that Officer.

(5.) In matters not specifically provided for in this Order, he shall obey and execute all the lawful orders and directions of the Sanitary Authority, and all the orders, directions, and instructions that We may hereafter make, issue, or give, applicable to his office.

CONGRESS AT GLASGOW.

CONFERENCE OF ENGINEERS AND SURVEYORS TO COUNTY AND OTHER SANITARY AUTHORITIES.

ADDRESS

By WILLIAM WEAVER, M.Inst.C.E.,
Borough Engineer, Kensington; President of the Incorporated Association of Municipal and County Engineers.

President of the Conference.

IN part recognition of the honour conferred in appointing me President of this section of the Congress, it is my duty and pleasure to offer a few remarks pertinent to the objects of this meeting.

The aim of The Sanitary Institute is to promote the advancement of sanitary science, and to diffuse knowledge relating thereto, and without doubt municipal engineers form an important factor in the advancement of the aforesaid aim of the Institute, and doubtless the papers about to be read will furnish evidence in this direction.

Sanitary science covers a much wider area than the suppression of nuisances; it embraces everything which tends to the physical and mental improvement of the nation, and so complex and interwoven are the issues of national life, that great care must be exercised in pushing reforms in one direction, in order that the good thereby achieved is not outweighed by the reflex action set up in other directions.

In a paper which I read in this building in September, 1901, I alluded to the partiality of sanitary effort for property only, leaving the insanitary individual untouched, free to stalk about and multiply broadcast, to the detriment of the community.

Since submitting the said remarks, one phase of the question has been taken up by the newspapers under the heading of "Pests in the Parks," with the result that the nuisance is, to some extent, kept moving; thus involving greater diffusion.

The good, old-fashioned "pass it on" doctrine will never successfully cope with the evil, and until sanitary legislation is made applicable to the individual, instead of being almost solely limited to property, national decadence must perforce proceed.

The great stumbling-block in the way of real reform is the religious sentiment as to the sanctity of human life; and although this sentiment is apt to be ruthlessly disturbed in time of war, when men in their thousands are ordered forward to certain death, such sacrifice is justified on national grounds, but at the present time such justification is not permitted to extend to the elimination of the unfit: on the contrary, every effort is in the direction of fostering the human failures, to the detriment of the standard of national vitality.

The mentally and physically totally unfit are allowed perfect freedom to breed broadcast, and it is quite within the range of possibility that at no very distant date, the incapables in public buildings will attain a percentage of population beyond the maintenance efforts of the outside workers.

In my opinion, it is in this direction that the preventive efforts of sanitary science should be directed, so that the proper breeding of the nation may receive equal attention as their housing, and the physical improvement of the masses may keep pace with the sanitary improvement of their dwellings.

Under the present law, any house which becomes dangerous or dilapidated to the menace of its neighbours can be demolished, but apart from notifiable diseases, the legislative protection of the community versus the individual is almost solely directed against acts of violence.

Sanitation should apply to the individual as well as to his dwelling, and without doubt cleanliness would materially tend to promote sobriety, the lack of which is responsible for nearly the whole of the mental and physical ills affecting the community. Incidentally, I hold a strong view that it is almost impossible for anyone taking a cold bath early every morning to become an habitual drunkard; the two habits are inconsistent.

Advanced civilization sows the seed of its own decadence by its involved concentration of population, and I am of opinion that no weightier subject can engage the attention of sanitary scientists than the best means to be adopted in maintaining the physical and mental standard of the race, for upon that standard depends the future of our country.

CONGRESS AT GLASGOW.

CONFERENCE OF VETERINARY INSPECTORS.

ADDRESS

By Prof. JAMES McCALL, F.R.C.V.S.,

Principal, Glasgow Veterinary College.

PRESIDENT OF THE CONFERENCE.

MY first and a very pleasing duty it is, is to welcome you to this, the Twenty-second Congress, now held under the auspices of The Sanitary Institute.

True it is, that it has only been during the last few years that a special section of this great Congress has been devoted to a Conference of Veterinary Officers of Health; but from what I have observed I feel warranted in prognosticating that it will not be the least important section, and as time rolls on it is bound to prove more and more its utility and importance.

Judging from the apathy displayed by the Government of this country and the general public, it would appear as if the diseases of the lower animals were so few and trivial, so easily diagnosed and eradicated, so dis-associated from those of the higher animal, man, that no government supervision or pecuniary aid was required to be expended in the education and training of the veterinary student.

Now I do not require to tell you that the diseases afflicting the lower animals are neither few nor trivial. They are as numerous as those affecting the human subject, and for obvious reasons much more difficult to diagnose; and, as regards their communicability, many of them are not only easily transmitted to man, but are quite as destructive of health and life in his case as in theirs.

Not only so, but some of the most loathsome and deadly diseases which afflict mankind would cease to attack him if they had not a prior stage of existence in the lower animals. As an example of this, I may mention

glanders, anthrax, rabies, certain internal and external parasitic diseases, and, in all probability, tuberculosis.

For these, and many other reasons which might be stated did time permit, I trust that the day is not far distant when the Government of this country, as in all continental countries of any note, will bring about an affiliation of the veterinary colleges with the medical colleges, and by a judicious expenditure of public money, will see that the education and training of the medical and veterinary student is alike liberal and efficient.

Such a consummation should have the support of every well-wisher of his country, for it would in time not only lead to a greater relief of pain and suffering in the higher and lower animals alike, but it would, as I have already stated, finally result in the stamping out of some of the most deadly diseases which at the present time afflict both.

My province, as I understand it, is more to preside over your deliberations than to introduce a subject or subjects for your discussion, so I will only take the liberty of placing before you one subject, and that is the housing or stabling of horses in towns and cities. As you are no doubt well aware, the housing of cattle, and more especially of dairy-cows, is regulated by "The Dairies Cowsheds and Milk Shops Order of 1885"; then under the Public Health (Scotland) Act, 1897, provision is made for the housing of pigs, and I think I am warranted in saying that ample provision has been made for securing for these animals all the creature comforts which they require. In fact, no building will be licensed as a cowshed or piggery, unless its construction, ventilation, drainage, and surroundings conform to certain definite specifications. But I regret to say that the Board of Agriculture have issued no order dealing with stables, and the consequence is that, in this city as well as in other large towns, many horses are stabled in hovels which are a disgrace to humanity, and in which no living creature should be allowed to reside.

I could take you to stables in this city, underground and aboveground, in which there is neither a window nor a ventilator nor a floor except the sodden foul-smelling earth, and in the same place and under the same roof, the dung is allowed to accumulate for weeks, and a stall is made to do duty for a dung pit.

The Local Authority of Glasgow, for whom I act as inspector under the Contagious Diseases (Animals) Act, have for years again and again brought this subject under the notice of the Board of Agriculture, and pressed them to pass an order, giving local authorities the power of licensing stables, but as yet without effect. It is well known

that Government departments seldom initiate reforms which involve greater responsibilities, and knowing this and seeing the Board have turned a deaf ear to the solicitations of the local authorities to have stables licensed as well as cattle-sheds, I have taken this opportunity of bringing the subject under the notice of this influential Congress.

I have no desire to circulate the opinion that glanders, a disease which annually destroys a large number of horses in London, Glasgow, and other cities, and which claims as its victim now and again the keeper of the affected animal, can originate from defective hygienic conditions; but I know that when once the disease claims a victim under such conditions, it is but a matter of time until the whole stud becomes afflicted. As an example of this and the rapidity with which the whole stud may become affected, I will briefly refer to an outbreak of glanders which came under my notice a few weeks ago. The stud consisted of eight cart horses, and they were housed under a broad railway arch. The heads of the horses ranged along the dead wall, so that the atmospheric air which entered the arch from either side was vitiated before it passed any length across the arch, and the horses in the centre breathed nothing but foul air. The walls were damp, in fact water was exuding from and running down the walls, it was dripping on their backs, and pools of it filled holes in the floor, and when the animals lay down, their bodies rested in it. The floor was coated thickly with dirt and dung, and worse than all, tons of dung were contained in a corner of the arch, so that the animals were forced to breathe the foul emanations therefrom.

The stall divisions were broken down, and the mangers being continuous the animals fed promiscuously.

The owner, finding that three of his horses were unable to go to work, and that all of them were looking ill, resolved to communicate with me, and having done so, I, as inspector of the local authority, at once visited the stables. On entering the stable I found one of the horses lying dead. Its death had taken place immediately before my arrival, and the cause of death was glanders. Standing alongside the dead horse were two other horses in an emaciated condition, and they also on examination proved to be glandered.

The owner having informed me that the other five horses were out at work, I arranged to return and inspect them on their return from work the same evening. Returning to fulfil my promise I was told that one of the five horses on his way home had fallen in the cart, and that he was unable to rise, and therefore he was slaughtered and removed to the knackery. The remaining four horses, being of little value and in a highly

suspicious [state, were at the owner's request slaughtered, and a post-mortem examination of all the five animals demonstrated the existence of glanders nodules in all their lungs.

Now I admit that this, in some respects, is the most malignant outbreak of glanders which has come under my notice, and undoubtedly the damaged grains on which the owner admitted he had fed his horses, and the facilities afforded while feeding together of inoculating each other, largely account for the rapidity of the spread of the disease to all the animals; still, if the construction of the stables, the ventilation, and other hygienic conditions had been such as in the cowsheds under license, then such a catastrophe and sacrifice of animal life and property could not have arisen, and I hold (to put it no higher than in the interests of horse proprietors, and leaving humanity out of the question) that it would be to their direct pecuniary advantage to have all stables in towns licensed.

CONGRESS AT GLASGOW.

CONFERENCE OF SANITARY INSPECTORS.

ADDRESS

By T. F. STRUTT,

Late Chief Sanitary Inspector, City of Westminster.

(Member.)

President of the Conference.

IT gave me very great pleasure to be called upon to preside over the conference of my brother officers in connection with the Congress of The Sanitary Institute, and the pleasure is enhanced when I reflect on the past and note the advances in sanitary science, due to the efforts of the Institute which has been good enough to invite us once again to take part in their Annual Congress of Sanitation in this important City of Glasgow, and I trust that our deliberations may, by the interchange of ideas, prove beneficial to us as inspectors, and stimulate our actions in the cause which we have at heart.

With the general duties of a sanitary officer you are so well acquainted that I will not take up your time in a recapitulation of the multifarious duties we have to perform, but proceed to address you on the questions which are uppermost in our minds and in the mind of every sanitary inspector throughout the United Kingdom, viz., "tenure of office, superannuation, and unity of our forces in the endeavour to obtain an amelioration of the grievances from which we suffer."

I do not believe that if the public knew how oppressive are our grievances and how they hinder sanitary effectiveness, we should any longer suffer from insecurity of tenure in our appointments, because as matters stand at present the unjust conditions under which sanitary inspectors hold their appointments are a standing menace to public health. How can a sanitary inspector be expected to do his duty fearlessly, when

the council which employs him, is, as is commonly the case, composed of tradesmen, slum-property owners, house farmers, the jerry-builders and their friends? So long as he does not molest the vested interests of his employers he may probably hold his appointment in security, but let the inspector prosecute any of his employers for adulteration, or discover defects in the drainage of slum-owners' property, and he is at once a marked man, and may, when the time comes for re-appointment, not be again elected.

Members of Parliament and the press should realise that it is of little use passing Public Health Acts if the hands of those appointed to enforce them are tied, by placing them in a position where they can be terrorised by the very class whose evil deeds they are supposed to prevent.

What sane man would approve of placing the police of the United Kingdom under the jurisdiction of the criminal classes and give them the right of appointing as well as powers of summary dismissal of any policeman of whom they do not approve? Such a state of things would be absurd, yet it is practically paralleled in the case of ourselves. Only the other day, when Mr. Walter Long was waited upon with the reasonable request that a measure should be introduced providing that the health officer should have the right of appeal to the Local Government Board in case of dismissal, he scouted the suggestion, and thought there was no need to interfere with the terms of appointments, and the officer who is appointed for one year ought not to feel aggrieved if the local authority fail to re-elect him for a further term.

I say the present position is not only an intolerable injustice but is against the public welfare; it is the most powerful factor in encouraging adulteration and spreading disease. It ties the hands of zealous officers, and induces them into acquiescence in many things they would otherwise condemn. It is shameful and a disgrace to Parliament that it should turn a deaf ear to our complaint, and afford us no protection for the proper performance of our duties to the public. It is a danger to the public health, and the more zealous we are in seizing unsound food, prosecuting the fraudulent tradesman, and compelling the owner of insanitary property to put his premises into proper sanitary order, the more certain are we of making our appointments insecure. I think the press of the United Kingdom would do well to devote some attention to this serious evil, and afford us its powerful aid in removing such a bar to sanitary efficiency.

Times over we see complaints in the press about adulteration being unchecked, but do those who complain, or who write so fervidly upon the question, realise that adulteration flourishes because it is fostered and pro-

tected by law, and we, the sanitary officers who could suppress it, are at the mercy of those who profit most by wholesale frauds?

In pleading for protection against malevolent and interested opposition to our work and unjust dismissal, I do not ask for the referendum to the Local Government Board for selfish reasons, but on the wider grounds of public benefit.

A Royal Commission has recently proclaimed consumption in men and cattle to be probably an identical disease, and as far as can be demonstrated in these days when experiments as to its communicability from animals to human beings by the flesh or milk are not permitted, the Royal Commission tells us that this devastating disease, tuberculosis, which slays in Great Britain alone nearly 60,000 yearly, is propagated by tuberculous milk and meat. Statistics show that nearly one half of all deaths occurring between the ages of 25 and 35 are due to this disease. In Scotland about 7,150 die from it every year. In England the rate of mortality due to it is 135 per 100,000. The London rate is 177, that of Edinburgh 191, and for the south-western district of Scotland it is 193, the highest north of the Tweed.

Now let us see the price the public pays for not giving the sanitary officer fixity of tenure in his office, for such I hold would be the effect of the right of appeal to the Local Government Board, as we could safely rely on the Board not putting its veto upon the discharge of any officer whose conduct was such as to merit dismissal by the town council or local authority employing him.

I have no means of obtaining the figures of the milk supply for the whole of the United Kingdom, but a very little reflection will convince anyone that the public, in addition to the risk of contracting tuberculosis by infected milk, is defrauded of an enormous sum, possibly a million or more, of money annually, by the present ignorant and unscientific milk legislation.

There is the scientific work of Dr. Veith, Mr. Droop Richmond, and others, based upon the analyses of some 300,000 samples of mixed milk of herds (and it should be borne in mind that the milk supply of large towns is, with few exceptions, the mixed milk of herds) proving that the fat (or cream as the public knows it) is more often nearer four per cent. than three, and seldom falls below three and a half per cent. But what does the law do? It establishes a fraud-fostering standard of three per cent., thus offering a premium to the dishonest dairyman by inviting him to adulterate genuine milk to the debased standard, and it even out-Herods Herod in folly by further covering him with the protection of a warranty, behind

which he can screen himself should the sanitary inspector try to stop his roguish practices. In May and June the fat is usually the lowest, falling to 3·30 per cent. average composition for morning milk, and 3.50 for evening milk, but in the other months it averages 3¾ per cent. A very little calculation will show how the dishonest dairyman can and does avail himself of the temptation to fraud. Say for example he takes twenty gallons of mixed herd milk containing 3¾ per cent. of fat, he can add to this four gallons of separated milk, having ·10 or so of fat, and one gallon of water to reduce the caseine to due proportions, and out of every twenty gallons he makes twenty-five, thus:

20 gallons pure milk	...	3·75	=	75·00
4 " skim "	...	·10	=	·40
1 gallon water	...	·00	=	·00
Divide by 25	...			75·40 ... 3·1

Just over three per cent. legalised by the Board of Agriculture. The water used for the adulteration may be pure or not, according to the sanitary condition of the dairy farm. Mr. Rider Haggard has told us from actual observation what those conditions too often are, the water supply being the pond that the animals pollute, covered with slime and swarming with lower animal organisms.

Can we wonder that there is no decline in infantile mortality, that despite all our boasted advance in sanitary perfection, it is as high as it was in the middle of the last century, and averages throughout the whole of England and Wales 154 per 1,000.

I would ask the press and the public if it is in the public interest that the sanitary inspectors, who could do so much to reduce the slaughter of the innocents, should be in the position that the men whom they should prosecute for these frauds have it in their power to dismiss the inspector from his office and ruin him should he dare to assert the right he is supposed to legally possess to protect the public and reduce this terrible death-rate? But Mr. Walter Long is unable to see that we have any grievances, and, like Pangloss, believes "everything is for the best in this best of all possible worlds." Well, I don't. I think that such a death-rate among infants is a disgrace to a civilised country, and if the public and the press understood the bald measure of justice we ask, I am sure we should be accorded forthwith the right of appeal to the Local Government Board in case of dismissal; but government fatuity goes even further in protecting fraud than in sanctioning a three per cent. milk standard, and making the inspector who should suppress adulteration the servant of those who

practise and profit by it. The law provides the dishonest dealer with the protection of the warranty; now, what the effect of the warranty is most of you know by unhappy experience, it practically prevents you doing anything to suppress adulteration. Its absurdity is evident to anyone who has to deal with the milk supplies of large cities, and who knows by experience that a warranty is a hollow imposture out and out. Take the average small milkman who obtains his supply from any of the London milk companies. He wants, say, twenty-five gallons for his customers, the churns are there at the railway station or at the depot, one containing twelve gallons, another fifteen, another fourteen, and so on, all from different farms. The milkman receives fifteen gallons from one and ten from another churn, or perhaps his supply may come from three or four churns, the produce of as many different farms. Now, against whom can any warranty honestly operate in case the milk be afterwards found to be adulterated and not by the retailer. The retailer can plead a warranty, the wholesale dealer can plead it, and the consequence is that never in the memory of sanitary experts has adulteration in milk been so widespread or so impossible of punishment as it is to-day, thanks to the three per cent. standard, the warranty defence, and the fact that the sanitary inspector has no security of tenure of office, and is liable to be thrown over at the annual election for being energetic in doing his duty. I have often heard the magistrate, before whom the retailer is brought for adulteration, advise him to seek the protection of a warranty, and what the quality of the London milk supply will be when the magistrates' advice is adopted by those who have neglected it so far, is horrible to contemplate.

There is another side to this question, and that is its effect upon dairy farming, which is worthy of the attention of those who are concerned with British agriculture. A proper enforcement of the Acts would mean an increase of at least five per cent. or probably ten in the milk consumption, and what this means to the dairy farming interest is obvious.

When I ask for fixity of tenure in their appointments for sanitary inspectors, I do so because I am firmly convinced that it is necessary in the public interest.

The medical officers of health in London have it, and in the provinces they enjoy some security, but they are not the persons who have to do the sanitary work. Some merely take the inspector's report and too often the credit for any meritorious work when it is accomplished. I do not complain that the medical officers have fixity of tenure, but I do say the sanitary inspector stands in far sorer need of this protection, because to him dismissal too often means ruin, but to the medical officer it means

nothing of the kind, he has his profession and can return to general practice, whereas the sanitary inspector has no chance of further employment if over a certain age, or if those who dismiss him have a grudge against him, for they are under no obligation to give him a character.

It may seem a strong thing to say, but I am certain that the health of the people of the United Kingdom depends more than most sanitary experts imagine upon the protection which the sanitary inspector asks for.

Take, for example, the finding of the Royal Commission that tuberculosis is communicable to man by the flesh of animals as well as by their milk. Every experienced inspector knows that the position of the butcher is an anomalous one, probably because like the sanitary inspector he has no powerful parliamentary representation and consequently but few friends in the legislative house. The butcher who buys two or three beasts has no means of knowing if they are afflicted with tuberculosis, and as his purchase may often absorb all his trading capital, it is hard lines for him should they be found on being killed to be tuberculous. He cannot recover the money from the cattle dealer, and his temptation is strong to take the risk of selling the meat which until lately so many scientists would scarcely pronounce definitely as dangerous to health. Prof. Macfadyen applied the tuberculin test to her late Majesty's herd at the home farm, and found that thirty-six out of the forty animals were attacked by the disease, albeit, as he instanced, these animals were probably the best housed in the kingdom from the point of view of cubic space, light, ventilation, and cleanliness. That there is an enormous amount of tuberculosis among cattle is beyond dispute, and the report of the Royal Commission must inevitably result in more stringent measures being taken to prevent tuberculous meat being sold to the public. What the butchers will do to protect themselves, whether by insurance or warranties, is not a matter within the province of this address, but it is obvious that the sanitary inspector will be looked to to exercise great vigilance against possible tuberculous meat and milk. I could give reasons innumerable why you should have fixity of tenure in your appointments, but I think the few I have adduced should be sufficient to convince the press, the public, and members of Parliament. The public welfare demands that our claim should be promptly conceded.

I am glad to say, with some confidence, that the movement for justice to sanitary inspectors is progressing, if not by leaps and bounds, yet sensibly, for we have seen in recent issues of some daily papers that the

absurdity of our present insecure position is being recognised by the public as a danger.

But are we doing enough ourselves to educate the public, and above all that most important part of it, the members of Parliament, upon the question. I am afraid not, and one of the main drawbacks has been the want of unity. We all know the wise fable of Æsop about the bundle of sticks, and I know of no reason why the whole of the sanitary inspectors of the United Kingdom should not be members of one association, working earnestly for justice to sanitary inspectors, and greater sanitary efficiency; and why there should be more than one association has always been a puzzle, and a lamentable one, to me, because our energies are more or less wasted by the absence of co-ordinated effort.

I am convinced that if we would resolve to unite and agitate for fair play for sanitary inspectors, and persistently bring our grievances to the notice of the press, the public, and Parliament, we should be able to secure fixity of tenure in our appointments and superannuation.

I know of no body of men in the service of the public whose claims are more incontestable. The soldier may have years of peace ere he risks his life in the horrors of war, but the sanitary inspector must ever take the risk of disease and death, fearlessly doing his duty to the public, by entering the foul places of the earth, purifying and making them wholesome, fighting the demons of small-pox or of fever, battling against the powerful and malign influences of the slum-property owner, the house-farmer, the jerry-builder, and others, who in some form or other make money out of slums, overcrowded dwellings, or adulterated or unwholesome food. I am sure that were we united, and were we to use all our powers and explain fully and persistently to the press and the members of the Houses of Parliament how injurious to the public welfare is our present system of tenure of office, we should soon get from Parliament the right of appeal to the Local Government Board against dismissal from office. There are many of us who are acquainted with members of Parliament, and I can say from personal experience that the bulk of them are not aware that we are liable to dismissal by the town council or other authority who employs us, without an appeal against that dismissal, however unjust or malevolent it may be, or if it be engineered by some slum-property owner whose drains we have found necessary to condemn, or some grocer or milkman whom we have prosecuted for adulteration. But we must speak with one voice and one effort to influence members of the House of Commons, and to obtain the ear of the public through the press

must be the well thought out policy of a council, speaking with full authority for every sanitary inspector in the kingdom. Our policy, to paraphrase Danton, should be "Unity, Unity, and, above all, Unity," for there lies our strength. My own opinion is that whenever Parliament is sitting, no opportunity should pass without some member of our association being in the lobby of the House of Commons and seeing the member of Parliament for his division, explaining our grievances and the reasonableness of our demands; we should have not one, but half a dozen measures drafted and taken up by different members of Parliament, so that if one fails to secure a place in the balloting, another may not, and we should, in season and out of season, bombard the press with letters, secure interviews, etc., until the real nature of the peril to the public, our insecurity of office, is made clear. In other words, I advocate a policy of enlightened and persistent agitation by a united body of the sanitary officers of the United Kingdom.

I have been asked to say a few words anent a Government Department of Public Health. Well, a dream that every one of us would wish to see become a reality is a Ministry of Public Health; but in advocating this very vital reform let us take warning from the fate of others, who have expended their energies in securing ministers for special departments, and, having obtained their wishes, have found out that they gained nothing.

I am as anxious as any man living to see a British Ministry of Public Health, but I do not want one fashioned upon political lines, governed by a party chief ignorant of practical public health science and problems. Far better, I say, to be without one, unless its head be a practical public health expert, such as Sir James Crichton-Browne, Sir Michael Foster, Sir Walter Foster, or like men, who have achieved distinction in their professional work as well as socially and politically; and in our advocacy of this very much needed department we should never lose sight of the fact that unless it be manned by experts in each branch of sanitary science, it would be a humbug and probably a curse.

To a Ministry of *real experts* the questions of examinations for sanitary diplomas, of the relative duties of medical officers of health and inspectors, of a referendum in case of disagreement by the local authorities, and of special regulations for noxious and dangerous trades, etc., could safely be left.

In conclusion let me express the deep debt of gratitude every sanitary inspector, and I may say the whole of the public, owes to The Sanitary Institute for its sterling service to the people in organising and ensuring efficiency in public health work. The Sanitary Institute was the first to

recognise the necessity of special training for sanitary inspectors, and carried this into effect by organising lectures, demonstrations in sanitary science, the holding of examinations, and the granting of a certificate in sanitary knowledge. What inspector has not felt himself richer by the possession of that diploma? The Institute has done much to raise the status of the sanitary inspector, and I feel that I am speaking on behalf of the sanitary officers of the United Kingdom in thus expressing our gratitude.

What a Government Department ought to have done but has not, The Sanitary Institute has done with a thoroughness and devotion which no words of mine can sufficiently praise. The Institute has raised the standard of sanitary science and sanitary officers, and can honestly claim to have been a most potent factor in achieving the diminution of the death-rate and of sickness, which means the saving of many thousands of lives, and hundreds of thousands of pounds of money every year to the nation. From my heart I say that The Sanitary Institute is an institution of which every inhabitant of the British Isles has every cause to feel proud, and that it may long continue its honoured and glorious career of public service and usefulness is, I am sure, the sincere wish of everyone concerned with public health work.

CONGRESS AT GLASGOW.

CONFERENCE OF WOMEN ON HYGIENE.

ADDRESS

By Her Grace the DUCHESS OF MONTROSE.

PRESIDENT OF THE CONFERENCE.

IT is with the greatest diffidence that I rise to say a few words at the commencement of our proceedings to-day, as I am fully conscious that many others here are far better qualified than myself to address you on this all-important and far-reaching subject of hygiene.

The only qualification I can lay claim to for occupying this chair is my great interest in the subjects to be discussed, and my belief that women can be of special service in promoting and encouraging the advancement of hygienic knowledge.

There is no doubt that education during the last thirty years has made huge strides, and that many advanced subjects are now taught in Board schools which to a former generation were unknown; but when so much is heard of physical degeneration amongst the poorer classes, doubts must arise as to whether the practical side of education is sufficiently considered.

Is there not something wanting in our educational system, if ignorance prevails in that most necessary branch of technical education, the technic or art of keeping oneself in health? Assuming that physical degeneration results in a great measure from causes which are preventable, namely, to neglect of the laws of health, to the evil effects of overcrowding, unsuitable food badly cooked, sleeping in unventilated rooms, it is manifestly important that the science of health, which is too often neglected in our curriculum of so-called education, should be taught—the rudiments of it, at least—in every school and college.

Why should not every child in our Board schools be taught the value of fresh air, pure water, wholesome food, and all that relates to a condition of health, and on the other hand all that tends to create disease? We might anticipate great results therefrom in the next generation.

It is appalling to see the number of city children who suffer from sore eyes, bad teeth, and rickety bones, yet this deplorable state of things might be combated if parents understood more about health conditions and wholesome diet. Is there anyone, man or woman, who would not be better and happier with such useful knowledge, on which depends his own well-being and the well-being of his children?

No doubt the public mind is gradually awakening to the importance of physical instruction for the future men and women of the country, and probably in many schools such instruction is now being given; but much remains still to be done, and the teachers themselves need more physiological and health knowledge to enable them to carry out the teaching in a practical and efficient way.

For these questions relating to the science of health are questions which call for the attention not of statesmen and medical men only, but of every father and mother in the land.

Those who will have all the responsibilities of motherhood ten years hence are now in the schools, and can be taught the vital importance of these matters, on which the health of the next generation will depend.

We hear on all sides of the urgent need there is at the present time for fresh air homes for the cure of those in the first stages of consumption, but there is little doubt, if the essential principles of health which render these fresh air homes so salutary were carried out to some extent in the cottages of the working classes, especially fresh air by night as well as by day, the necessity for these homes might cease to exist.

Another important matter which receives far too little attention in school life is the physical development of girls.

It is distressing to see amongst girls of the poorer classes the round stooping shoulders and narrow chests, which are so prevalent. Yet how much might be done by physical exercises of all kinds in school—and suitable loose clothing worn to permit the chests and lungs of growing girls to develop, if only the importance of this were realised.

Efforts are also needed to counteract the tendency which prevails amongst young country girls of the present day to rush for employment to towns and cities, seeking occupations there for which they are often physically unfit, and setting no value on the sound practical training they could obtain in useful household duties, which would fit them to become good wives and wise mothers.

A great responsibility rests upon women to further these objects. In past generations women erred in these matters through ignorance, but medical science in these days has so advanced that we can no longer plead

that excuse, and as woman's sphere of influence is now so much enlarged so has her responsibility increased.

Interest has awakened in all these subjects, and women have it in their power to do lasting good if they will but exert the vast influence they undoubtedly possess in ameliorating the condition of the poorer classes.

The good work accomplished through the medium of The Sanitary Institute in recent years is to throw valuable light on these important questions, health and sanitation, and that light, we can thankfully say, is widening and deepening steadily.

I know that many here to-day are actively engaged in most useful work for the betterment of the working classes, and I trust the discussion of the numerous interesting papers on the list before us may further the object we all have in view, which is for each of us to aid this work to the best of our ability; work which will tend to improve the health and well-being of the poorer classes of the community in the next generation.

CONGRESS AT GLASGOW.

CONFERENCE ON THE HYGIENE OF SCHOOL LIFE.

ADDRESS

By Prof. JOHN EDGAR, M.A.,

Professor of Education, St. Andrews University.

President of the Conference.

HYGIENE AND THE TEACHER.

THIS important conference on School Hygiene is one of many signs of the great expansion which is everywhere taking place in modern ideas of the scope of education and the function of the teacher.

Gradually but surely the belief is gaining ground that school is a preparation for life; and not only a preparation, but a real and important part of life. It is now being recognised that the teacher is more than an instructor in reading, writing, and arithmetic, in classics and mathematics. He is an important factor in the highest of biological processes, and in social evolution. For education, in biological terms, is the adjustment or adaptation of a growing human being to his environment. With the evolution of society that process is growing in complexity. And it is the teacher who must, in the light of experience and science, direct a considerable part of this process.

The environment of the child is partly physical and partly spiritual. Neither side can be safely neglected. The education of the future must take account of both, and must realise that the two sides are intimately connected.

Education may now profit, and is indeed beginning to profit, by the fruitful labours of science. In the fields of Biology, Physiology, Hygiene, and Psychology, earnest workers have in the last generation added enormously to our knowledge of body and mind, and of the laws of health. Educational thinkers are setting themselves to find out the practical

bearing of scientific discovery upon the guidance of human growth. A new conception of the meaning of education and the teacher's work is taking shape. This new conception is based upon our increasing knowledge of the human organism, of the laws of its working, of the conditions of its healthy life and growth, and upon the application to human life of the principle of evolution.

"Sound educational theory to-day," writes Prof. Nicholas Murray Butler, "finds no place for any mental training which overlooks the relation of mind and body and its hygienic and ethical import. It is not too much to say that health, its provision and protection, is all-controlling in present-day educational theory, although it is unfortunately far from being so in practice. The chief reason for this discrepancy between the ideal and the real is simple ignorance."

But this ignorance is now doomed. For a while the protests of enlightened medical men, like Sir James Crichton-Browne and others, were as voices crying in the wilderness. But their protests reached the ear of our Education Departments, and the public schools of the country have been more and more modelled on hygienic lines, and increasing attention has been paid to healthier conditions of work and to the spread of hygienic knowledge. The Royal Commission on Physical Training (Scotland) laid down as the first principle of a national system that "physical training should be regarded as of equal importance with mental training." And the Inter-Departmental Committee on the Model Course of Physical Exercises, in their admirable report recently issued, carry this principle a step further. "It has been forced upon the Committee, in the course of their deliberations, that important as the question of physical exercises for schools is in itself, it is only *part of a much larger question*, viz., that of school and personal hygiene." "The construction of a suitable course of exercise is conditioned throughout by considerations relating to the health of the children." This report will, I hope, be placed in the hands of every teacher; and it deserves, and will repay, the most careful study. It is at once scientific and practical, and should do much to promote our physical welfare. Let me quote with the heartiest approval the following passage from Section 9: "As regards future teachers, we suggest that suitable instruction in the laws of health and in the outward signs of physical and mental weakness should receive a much more prominent place in the scheme for the training of teachers than appears to have been the case hitherto. For this purpose no mere bookwork instruction, such as may be necessary for passing written examinations in physiology and hygiene, is sufficient. The instruction should include a certain amount of,

so to speak, clinical experience. The students should be made acquainted practically with the indications of normal health and normal physique, and taught how to recognise probable deviations from this standard. They should be able to recognise such signs of defective nutrition, and such defects of sight, hearing and breathing, as require medical attention. They should also be familiar with the signs of fatigue, physical or mental, which to the experienced teacher are the gauge on which he keeps his eye in regulating the work of a class."

The teacher must indeed have a thorough knowledge of subjects of instruction; but if he is to be an educator as well as an instructor, capable of guiding the growth of each individual pupil towards his highest social fitness, or of scientifically directing his process of adjustment, he must know in addition, and know theoretically and practically, (1) the nature of the growing organism, the child, (2) the physical environment best suited to its health and growth. This combined knowledge may be called hygienic physiology, but is what I personally understand by school hygiene. Such knowledge I consider necessary in some degree for every teacher, and it will, I hope, become a fundamental part of his future professional outfit or equipment.

Whether the teacher be head master or assistant master, special master or class master, he requires this knowledge for his pupils' sake, for his work's sake, and for the country's sake. He will find it also useful for his own sake. For one of the most important factors in education is the personal influence of the teacher himself. The teacher is his own chief instrument. He should know, therefore, in what conditions he can work best, when he is most and least effective, and so arrange and divide his work as to take full advantage of his own power and energies, and utilise in the best and most economical way his own chief instrument.

Education has now become a great national concern, and constitutes, when properly understood in its wide sense, the greatest of national interests. The introduction of hygienic physiology into the sphere of the school means that science and enlightened experience are now to take their proper place in education, that mind is to aid more deliberately in the evolution of the nation and the race. The teacher should be the practical expert in the guidance of growth towards the highest possible for each individual. He should go forward to his task equipped with the fullest knowledge which science can give him of the physical nature of the child, of individual variations, and of the laws of growth. Like an artist he must have an ideal and a method, but he must also know his material, and the conditions in which it is best moulded.

Science has recently made great progress towards a thorough understanding of the most favourable environment for the healthy growth of all children. Growth, we know, is dependent on the one hand on the vital energy in the body, and on the other on the supply of food, light, air, heat, and on the proper alternation of movement and rest. It proceeds usually on certain general normal lines. But no two children are quite alike, and deviations from the normal are exceedingly common. What is the best course for one child, may be positively harmful to another. Science is able to give assistance with the individual peculiarities as well as with the general rule, and to aid in the superior or successful adjustment of each child to its complicated environment. True education should aim at making the best possible of every individual. It should make allowance for difference of constitution and temperament, but should reach a high standard in each type. The old rough distinction into clever boy, average boy, dull boy, should give place to a recognition of the individualities of children, and a knowledge of the best way of dealing with each. When education has been enriched by this knowledge and spirit, it will really be, under another name, that science of Eugenics, for which some thoughtful inquirers are seeking. It will at any rate tend to conserve and improve the national health, happiness, and fitness.

The time then has come when hygienic physiology, or school hygiene, should be recognised and demanded as part of the professional training of every teacher. It matters not that many, or even most teachers, may not be called upon to *teach* hygiene. The teaching of elementary hygiene to pupils is not at present under consideration. Such instruction should be given in every school, and in every class of school, so that the knowledge of the laws of healthy living should be as widespread as the ability to read and write. What I am specially insisting upon is practical hygiene and that physiological knowledge of children which every teacher needs for the fulfilment of the higher duties of his profession. Every master has not only to teach subjects but to educate living beings. How will a knowedge of physiology or hygiene help me to teach mathematics? This question was put to me not long ago. It will help you in many ways, was my answer, not only to teach mathematics, but to educate boys.

A professor of mathematics once stated in my hearing that he could sometimes see his students visibly breaking down. He was quite surprised when I asked him, Why do you not stop them when you see the symptoms? A teacher's duty should carry him beyond his subject to the living pupil.

Whether a teacher is responsible for classics only, or for mathematics

only, or for the whole work of a class, he has to do with a certain part of the time in which growth is proceeding, in which a young life is adjusting itself to its environment, and his work is, by certain subjects, to guide the growth or facilitate the adjustment in special directions. He should know, for example, whether the temperature and atmosphere of his room are suitable for class work; whether the light is sufficient and properly arranged to allow of every pupil seeing without eye-strain; whether the shape or arrangement of the seats is likely to encourage proper posture; whether, as a whole, the class before him is fresh or tired, and whether individual pupils of a weak or neurotic constitution are physically and nervously fit for the special exercises before them. He should know how long he may expect or ought to demand attention from the class or from individual members of it. And he should have a clear idea, in view of all the tasks imposed upon the pupils, and of their individual peculiarities, how much home-work is consistent with their well-being. He should be prepared for and able to deal with special cases of inattention, restlessness, stupidity, and even sullenness, because he is aware of the real cause. His knowledge of hygienic physiology will make him pause before resorting to corporal punishment, or losing his temper. He will thus show himself qualified not merely to teach his subject, but to guide the physical, mental, and moral development of his class.

As far as Scottish teachers in State-aided schools are concerned, the excellent recommendations of the Inter-Departmental Committee have already borne fruit. For the Education Department has issued a request to University Local Committees and other training authorities that all students preparing for the Teacher's Certificate shall hereafter receive not only theoretical but clinical instruction of a kind calculated to provide this hygienic knowledge, and to make that knowledge real power in the teacher's hands. It is still unfortunately the case that many teachers—especially in secondary schools—have received no professional training. But if one may interpret the sign of the times, the day is not far distant when the teachers in all schools of recognised standing shall have passed through a course of theoretical and practical instruction bearing upon their special life work.

And it is now, I hope, impossible for any student of education to go through a systematic course on the theory of education, either under a professor of the subject or otherwise, without having the fact driven deeply home that on one side education is a physiological process, that it is primarily modification of the central nervous system and the co-ordination of that system with the muscular and other systems of the body; and

further, that this co-ordination and organisation can be fully carried out only where there is a sound body and a healthy environment. This leads the student to realise the importance of acquiring some knowledge of the nervous system and its relation to the rest of the organism, and of being able to note and interpret the various signs afforded by movement, posture, speech, handwriting, rate of growth, and habits of conduct.

But why should such knowledge be a sealed book to the secondary teacher, and why should the hygienic standard of many secondary schools fall below that of elementary schools? The proportion of children in secondary schools who need special attention is, perhaps, not much less than in primary schools, and the strain of mental work is on the whole greater. Some of the best private schools do, indeed, pay a great deal of attention to the physical and hygienic side of education, and have medical men connected with them who advise as to the treatment of special cases. These schools do excellent work, but they are the exceptions in this matter. I am glad to know, also, that other schools are beginning to set their house in order, and to give full recognition to the importance of health and health-promoting arrangements. The Merchant Company in Edinburgh, for example, is developing some interesting reforms in its great schools for girls, and has appointed two lady doctors to examine and supervise the pupils. But still better results would be produced, even in these good schools, if all the teachers had received a training in school hygiene, and were thus able to co-operate more intelligently with the medical supervisor.

The work in secondary schools is more advanced, home-lessons add to the strain, the preparation for such examinations as the Leaving Certificate and University Preliminary necessitates long-continued and severe labour on the part of teacher and pupils. Yet many of the teachers have had no instruction in hygienic physiology, and in many of the schools the rooms are badly ventilated and over-crowded. The close and vitiated atmosphere leaves both master and pupils fatigued and nervously exhausted when the day is over. Further, in some of the schools no arrangement is made for periods of recreative exercise or short runs in the open air. My inquiries lead me to believe that in certain large secondary schools in Scotland, the pupils are not sent into the open air from the time school work begins at nine till the midday interval at 12.30 or 1 o'clock. When they leave one class-room they pass into corridors where the atmosphere is not much better than in the rooms. Their place in the first class-room is almost immediately taken by another set of pupils. Thus during a considerable part of the day, rooms are not regularly flushed with fresh air.

The energy and vitality of both teachers and pupils are lessened. Yet sustained and severe mental work has to be done in an atmosphere which is calculated to destroy the power of attention, and seriously to affect the health. The strongest teachers and the hardiest children may get along for a time without showing the evil effects, but many must suffer severely and perhaps permanently.

It is surprising that parents and medical men have not loudly protested against such a state of things in schools of good reputation; it is a pity that the teachers should be too long-suffering and bear silently with working conditions which are harmful to themselves and to their pupils. Hygiene must have more to say in drawing up the future time-tables of these schools.

Up till now, the secondary schools have admitted to their staffs men who have enjoyed no professional training whatever. That state of matters is apparently drawing to an end. If teachers were really serious in claiming that teaching should be ranked as a learned profession with its own special professional knowledge, they would insist that students preparing for an educational career in higher-class schools should devote at least one year, including both a winter and a summer session, to professional and practical training. This year should be spent in mastering the secrets of professional skill, and the student among other things should take a course in Hygienic Physiology. Such a course is well mapped out in the Syllabus of The Sanitary Institute. It would naturally include the following:

1. The physiology of the senses as related to school work. Methods of testing sight and hearing. The nascent and plastic periods of the various capacities and powers.

2. The muscular system and its relation to the central nervous system. Physical exercise, correct posture, value of alert and precise movements, importance of manual training, eye-drill, mouth-drill, meaning of facial twitchings and other 'tics,' fatigue, school seats, desks, and other furniture.

3. Light, air, and temperature in the school-room.

4. First aid hints for common school accidents, symptoms of common infectious diseases, nervous and nutritive signs, rate of growth.

5. Construction of time-tables to secure renewal of air, alternation of subjects, recreative exercises, rest periods for the teacher.

6. Clinical instruction in the schoolroom.

How is such a course of theoretical and clinical instruction to be given? There is no doubt that the demands upon the time of those students, who at the Universities and training colleges are preparing for the Teachers'

Certificate, are already almost too great. The course at present extends over two years. But the growing demands, both on the culture side and on the professional side, seem to suggest that another year should be added, and that the professional subjects should be spread over a three years' period. This would produce better results, and would prevent the present enormous strain on the health and energies of the students. The instruction at present given in physiology and hygiene is slight, and is apparently not intended to fit students to note and understand the physical condition and needs of the pupils. To meet the requirements of the Education Department, a course of a more practical kind will have to be organised by the various training authorities. For the success of such a course a great deal will depend upon the kind of lecturer appointed.

It is probable that after the passing of the Education Bill, there will be an earnest attempt made to reorganise the arrangements for the training of teachers. It is likewise probable that medical inspection of schools will be generally established. The Report of the Inter-Departmental Committee is very decided upon this point. "No form of educational organisation can be considered to be complete which does not make provision for the systematic reference of questions of school hygiene and the special treatment of individual scholars to medical experts." The Education Bill, moreover, gives power to school boards to provide for medical examination and supervision. Assuming, then, that medical experts are appointed to supervise the schools in each district, it would seem natural that these medical officers (who are not only to be "fully trained," but "to have made a speciality of this kind of work") should be asked to give a course of lectures on Hygienic Physiology to the teachers in their districts. Where local or district arrangements are made for training teachers up to the lowest stage of efficiency, this plan would work very well.

At the central training colleges, or the Universities, where the more capable students will receive their training, in addition to the lectures given by the professor of education on the subject, there may be a special lecturer appointed, and the medical officer, who is connected with the practising schools, would also be available. The clinical demonstrations could be arranged for in the practising schools. In every school of any size, characteristic types of children will easily be found for special observation and demonstration. The variations of height, weight, build, and habit of posture, the condition of the teeth at different ages, normal and abnormal palates, twitchings and other nerve signs, right and wrong ways of breathing and speaking, weak eyesight and dull hearing, enlarged tonsils,

etc., will easily be illustrated. It will be possible to show, also, how mental ability and moral characteristics vary with the physical type. And if the lecturer, or medical officer, "has made a speciality of this kind of work," he will be able to give most valuable hints as to the school treatment of the various cases as they present themselves.

What can we expect from such careful scientific training of the teacher? This, at least, that we shall have in our schools men and women who can by sure and reliable signs mark off the children into certain more or less definite classes. The teacher thus trained will recognise the children of weakly constitution, not likely to be able to bear great strain, but whose bodies and brains may be built up and strengthened by a wisely directed education, in which sunlight, pure air, exercise, and rest need more attention than the mental training; children also of a stronger physical type, whose abnormal nerve signs mark the unstable nervous constitution, and who may be made or marred by the nature of their education; the children, finally, of robust health and strong nerves, whose education need not give any special anxiety.

The teacher will also be able to assist the medical officer by taking accurate observations, and will have correct ideas as to how these various classes should be treated, so that each individual shall receive the education which he needs. The wise teacher of the future will thus, under the guidance of the trained physician, be able so to modify the education of the various children that all will have the best chance of growing into healthy and capable men and women.

When the teacher goes forward to his work, equipped with this special knowledge, he will take with him a source of increased pleasure and usefulness, and will be conscious of a scientific interest in his work, and a national importance in his profession, which have been too much lacking in the past.

CONGRESS AT GLASGOW.

LECTURE TO THE CONGRESS.

By SIR RICHARD DOUGLAS POWELL, Bart., K.C.V.O., M.D., F.R.C.P.

THE PREVENTION OF CONSUMPTION.

THE very title of my Address predicates that Consumption, Phthisis, or Tuberculosis of the lungs is a disease which is, to a considerable extent at least, preventable, and this fact has been long known to physicians and sanatarians. The disease was described by Hippocrates,[1] who, four centuries before the Christian era, first gave it the name of phthisis to signify the wasting character of the symptoms that attended it. It is, and has ever been, a disease of civilization; wild animals and wild people do not get consumption. Assemble the same creatures in farmsteads, zoological gardens, lunatic asylums, factories, villages, towns, cities, and consumption becomes the principal disease from which they suffer and die in the zenith of their maturity. This need not be altogether so. It is a confession that science has not kept pace with evolution. It is the aim of preventive medicine to counteract the misdeeds of civilization, to police its overcrowded conditions, to minimise the penalty that must be paid for its infringement of Nature's laws. If you contrast the conditions of wild life with that of civilized communities, be it in animals or men, you perceive that the difference is essentially one of acreage. The main differences between three acres to a cow, and three or more cows to an acre are questions of abundant air and sunlight, sufficient and simple food, and freedom from accumulated dirt contaminated by animal emanations. We may only be able to deal to some small extent with the question of acreage, but we can very largely amend the circumstances of crowded human life, and restore the air and sunlight, secure the food supply, and cleanse away and prevent the accumulations of filth, even in our most thickly populated districts.

I shall in a moment speak of the virus of tuberculosis, but again I wish first to point out, as I have done on a former occasion, that the prevention of consumption involves a much wider issue than the circumvention

[1] For references to Literature see end of lecture.

of a bacillus, although that troublesome little microbe is of its essence. In their day the abolition of the corn duties and other free trade legislation and improved rates of wages probably did more to diminish the death-rate from consumption than any notification law against that disease would have effected. Medical officers of health and their brethren in all ranks of medicine have ever been the urgent advocates of all measures of public hygiene, such as revised factory laws, amended conditions of labour, and general improvement in sanitation and house accommodation which have helped to reduce the mortality from consumption by well nigh 50 per cent. within the reign of Her late Majesty Queen Victoria. Much of this work was done whilst Professor Koch was yet a child, and the right lines of general hygiene and treatment with regard to the prevention of tuberculosis were laid down and were being gradually developed unwitting of the discovery by that great pathologist of the true virus of the disease.

The names of MacCormac, Parkes, Simon, Greenhow, Milroy, Buchanan, Bowditch, must ever be gratefully and pridefully engraved upon our memories as the great pioneers in preventive hygiene, whilst those of Villemin, Pasteur, Lister, Koch, will for all time endure as the great discoverers and demonstrators of the specific microbes through the agency of which filth works its fatal effects. Now that the searchlight of science is fully turned upon the actual cause of consumption (tubercle bacillus) and the principal auxiliaries (septic and other bacteria) by which its destructive action is promoted, sanitarians and physicians are working with renewed zeal and hopefulness in its prevention and its cure.

Before I go further let me briefly remind you of the chief features of the tubercle bacillus and of its coadjutors.

I will draw your attention to a fact which is not in my experience sufficiently recognised even by the medical profession, and which is as yet quite unknown to the public: that whilst the tubercle bacillus is essential to tuberculosis, it is to the agency of these other micro-organisms, the streptococci, diplococci, influenza bacilli and the like, but chiefly the septic organisms, that the conditions for the invasion of tubercle are commonly established; and to their aid also the destructive changes in the lungs are largely due, and the hectic symptoms of the disease mainly attributable. Once grasp this fact, and the main principles of prevention and of the treatment of consumption are realised and understood.

We as yet know for certain nothing about the life history of the tubercle bacillus, except what is revealed to us in that, shall I say, phase of its existence which is passed in the animal body, or in artificial cultures under conditions approximating to those therein found.

We know that the same or a very similar organism is responsible for the tuberculosis of cattle and birds and many other animals, and that bacilli, having the same staining properties and microscopic characters, are found widely distributed in certain grasses, in the dung of herbivorous animals, and in other places. Avian and bovine bacilli are only in degree less virulent to men than the human bacillus, and there is some reason for thinking that it may yet be found that the whole series are specifically related. The tubercle bacillus belongs to the vegetable kingdom, and is allied to the group of fungi. It is, therefore, foreign to the animal body, and will probably be found to be a derivation of some saprophytic organism, which has acquired its parasitic tastes and virulence from cultivation and transmission through animal juices and tissues. It finds thus some analogy with the bacillus of anthrax, of tetanus, with actinomycosis, and other earth-borne microphytes. If this be so it will be folly to suppose that you can wholly eradicate the source of the disease, but you may entirely or nearly remove the conditions under which it can become virulent to the human being. The human parasite cannot, for instance, live for five minutes in direct sunlight, and but for a short time in diffused sunlight, whereas it may remain virulent for months in dust and darkness, and in damp, dark localities it may even undergo a feeble growth.

Let me glance a little more in detail at some of the favouring and preventable conditions that make for tuberculosis.

Condensation of the population is one of the root causes of consumption, and this, like most other causes, is mainly operative amongst the poor. I will not stop even to summarise the indications for the removal of this cause. They are obvious enough, but in effective treatment they are amongst the very difficult municipal and State problems that call for deep and sincere consideration. There are, however, three interesting questions of far-reaching importance which are more urgently brought before us in thinking about the conditions present in the crowded tenements of our cities:—

The question of infection.

The question of infant mortality and physical degeneracy.

The question of milk supply and alcoholism.

Under experimental conditions, such as inoculation under the skin or spraying the immediately surrounding air with matter containing tubercle bacilli, tuberculosis can be directly communicated to animals and has accidentally been communicated to man. Cornet[2] showed that susceptible animals when sprayed with infected dust became tubercular. Flügge[3] more recently has shown that similar animals sprayed with watery

mixtures of sputum, or coughed at in a close cage for a given time by consumptive patients, acquired the disease. These and other observers[4] have shown, that upon the floors and surroundings of consumptive patients dust or foods left for a certain time will become contaminated by tubercle bacilli. These observations and experiments are valuable in demonstrating conclusions that logically follow from the fact that the sputum of the consumptive is laden with tubercle bacilli, and that under certain conditions that are directly experimental (and some unfortunate accidents have occurred to show this), and proportionately under conditions of concentration from over-crowding and bad ventilation, infection may occur.

Tuberculosis is a virus disease, and under certain conditions a directly infectious one. Now there can be no doubt that in our slums, in our dark alleys and crowded tenements, and in the dusty and dirty conditions in which many of our public places and conveyances are still kept, and with their contamination by dirty people, the required experimental conditions are approximated, and many persons acquire consumption who should not do so. Cases have been given by Cornet, by Ransome, by Newsholme,[5] and many others, pointing strongly to the fact that direct infection may occur under insanitary conditions. It is also true that infection may hang about certain houses in a very tenacious manner. This may perhaps be explained by the preservation of the bacillus in full virulence, and even a low degree of cultivation,[6] that obtains in dark and damp localities. But were all the conclusions with regard to person-to-person infection which have been drawn from these experiments unconditionally true, the treatment of consumption would be impossible: in the first place, no physicians or nurses would live to treat it; and in the second, any idea of collecting patients in sanatoria would be quite unjustifiable. The disease, instead of steadily diminishing, would soon exterminate all of us, for consumption, unlike most of the specific diseases, is not epidemic, and one attack favours, rather than gives protection from, another.

Looked at more broadly, however, the facts shape themselves rather to the conclusion that the poison is a distributed one and only in exceptional cases communicated directly from person to person. It is an exaggeration of an experimental inference to say that, with cleanly habits and reasonable precaution, consumption is an infectious disease from person to person.

An extensive examination in Paris and in this country of those who have died of other diseases or from accidents above the age of thirty, has shown that a large proportion of them present local lesions in their lungs of a tubercular nature,[7] of the existence of which they have been, for the

most part, in happy ignorance. Now this almost universal potential presence of the disease suggests, amongst many other lessons, an almost universally distributed virus rather than what we understand by person-to-person infection.

TABLE I.—ANALYSIS OF 450 CASES OF PHTHISIS.

Cases with a definite family history	208
„ „ no family history	123
„ of which history was not stated	119
	450

i.e., 208 cases with positive history;
242 „ history negative or not known.

Analysis of Relationship in the 208 positive cases.

	Cases.	Ages.		
		Average.	Max.	Min.
Father only, or father with collaterals	19	29	44	17
Mother only, or mother with collaterals	22	33	50	14
Brother only, or brother with collaterals	21	32	39	21
Sister only, or sister with collaterals	26	35	58	17
Grandparents only, or grandparents with collaterals	12	25	38	17
Several members in direct line (*i.e.*, father, mother, brothers, sisters, and grandparents)	43	33	58	16
Collaterals only (uncles, aunts, cousins)	59	26	42	7
Details of relationship not given	6	37	56	28
	208			
Age-Details of cases with history	...	31	55	15

Analysis of the 43 cases with several direct relatives affected.

Father and mother	4
Father and grandparents	2
Father and brother or sisters	5
Mother and brother or sister, or both	11
Two or more brothers and sisters	20
Brother and grandparents	1
	43

Look at this table, and you will see that of 450 cases of proved consumption taken consecutively back from the last cases of which I have notes, in 208 cases there is a definite consumptive family history. In 30

cases and 33 cases, respectively, the father or the mother have been affected, yet in only four instances have both of them been involved.* And even this proportion is greater than I should have given as my experience of many years of the disease with married people. The conclusions of Dr. Longstaff,[8] in an elaborate statistical paper, showed that there is no extra prevalence of consumption amongst the wives of consumptive husbands or the husbands of consumptive wives.

If you look to the records of the Registrar-General,[9] you will again find that there is no extra prevalence of the disease in districts which include consumption hospitals, with their large resident population and out-patient attendances, when proper corrections are made for the local hospital mortality.

It has been demonstrated that the mortality from consumption amongst the officers, attendants, and servants of institutions for the treatment of consumption is not and has not been above that of the average population.[10]

The very elaborate inquiries of Sir Hugh Beevor[11] into the distribution of phthisis over the areas of population of a large country district comparatively isolated from railway communication have shown that over a period of 20 years there has been a uniformity of prevalence in each district that is quite unlike the character of distribution of a disease having infection as its chief means of extension. The epidemic features proper to an infectious illness are singularly wanting in this type of distribution. Too much emphasis has been laid upon the so-called long incubation period of the tubercular infection. As a matter of fact tuberculosis produced by infection in animal experiments, and in unfortunate attendants through accidental infection, has developed with great promptness and rapidity.

I am only desirous that this question of the agency of direct infection in the spread of tuberculosis should be regarded calmly and in due perspective as a possibility, not to be ignored, but to be guarded against by avoidance of those almost experimental conditions of insanitation under which it may occur. I have especially in mind, too, the social tyranny which threatens the unfortunate victim of this disease in all directions at the present time, and the danger that with an exaggerated importance attached to direct as distinguished from distributed infection the readiness to receive the poison arising from other causes may be less strenuously considered.

* I regret that I only drew up this table at the last moment, and could therefore only collect the details of a few recent cases.

It may be said that all diseases, and especially all chronic diseases, tend to weaken resistance to the effective invasion of tuberculosis. I will not labour this point, but in illustration of it, I would direct attention to the fact that diseases so apparently unconnected with tubercle as cirrhosis of the liver and other chronic forms of alcoholism[12] find a very common termination in tuberculosis. The diseases which, however, especially favour tubercle are those which are attended with or leave some remnant of unsoundness of the lungs, such as measles, whooping-cough, bronchitis, influenza. Unfortunately, there has been but small diminution in the prevalence of these diseases, within the last decades. It is important here to note that the catarrhal complications upon which tubercle is so apt to be engrafted in these diseases are almost always attributable to the septic organisms inhaled from an impure atmosphere. Any measures, therefore, which purify the conditions under which such cases are treated will tend to prevent tubercular complications.

The metallic or mineral spicular dusts to which miners and grinders are exposed destroy the protective membranes of their air passages and produce an irritation of the lungs, upon which tubercular infection is easily engrafted. 23 per cent. of the Redruth miners in Cornwall die of phthisis as against about 8 per cent. from all other causes,[13] whilst the death-rate from that disease amongst the rest of the population in this district does not exceed the normal. We may look to a great diminution in this death-rate, which is largely preventible.

Hereditary influence has more to do with the incidence of phthisis than is generally accepted. Up to recent times, before the discovery that a specific microbe was essential to the incidence of many diseases, the terms hereditary disease and hereditary tendency to disease were almost synonymous and were frequently so employed. But, perhaps with the exception of syphilis and smallpox, the actual hereditary transmission of a virus is almost unknown. The majority of acknowledged hereditary diseases, such as defects and deformities, are of the nature of atrophies or of redundancies from want of trophic nerve control. There is no virus in the question, but a defect in the formative power or control. We again cannot explain away the facts that rheumatism, gout, neuroses, alcoholism, loss of hair, arterial degeneration, and premature senility run in families. Further, it cannot be denied that certain families are more vulnerable to specific infections, such as ringworm, scarlet fever, enteric fever, and that such diseases run in them a graver course. In these cases there is no question of transmission of a virus from parent to child. The only rational explanation would seem to be that some subtle mal-formation or impaired

trophic power of a tissue or set of tissues belonging to one or other of the primary plasmic layers is inherited.

Such a view brings at once all the cases of hereditary predisposition to disease in line with hereditary atrophies. The disease itself may come through infection, as the sickly forest tree is attacked by lichens, according to its peculiar defect: or it may arise through the undue growth of an inferior tissue, as a soil sterile to wheat will grow tares: or it may come by way of chemical deposition, a defective adequacy in cell power: or again, the mere tenure of vitality is restricted, old age prematurely arrives in certain tissues or in the whole organism. Some recent authorities have roundly asserted that heredity plays no part in tuberculosis, and that insurance offices are wrong in rejecting or surcharging a life on hereditary grounds. As, however, a lawyer may plead for his client "not guilty" and "justification" at the same time, so the more cautious of those who deny heredity in tuberculosis maintain that the family prevalence is really due to infection.

Mr. Hoffman[14] brought before the British Congress some statistics which he regarded as discrediting the value of family history as a factor in the ætiology of phthisis. He declares that for assurance purposes at least family history is of no value, and indeed often misleading. The statistics he brings forward, however, when carefully scrutinised, do not seem at all to bear out his position.

By an ingenious plan, Mr. Hoffman's medical colleague, Dr. Hamill, made a special note of 40,000 persons, who coming up for a second assurance were rejected for one reason or another within a period of twelve years. Of these, 16,532 were males, and 5 per cent. of them died within that period from consumption.* A further analysis shows that—

Of 958 rejected for personal consumption, 22·5 per cent. died of that disease within the period stated.

Of 496 rejected for family history alone, 5·3 per cent. died of consumption.

Of 15,078 rejected for causes other than either personal or family consumption, 3·9 per cent. died of consumption.

When we remember that these lives were all rejected and the results recorded within twelve years, and that their currency cannot therefore be taken to have averaged more than five or six years, a mortality of 3·9

* I am indebted to Mr. Besant, Assistant Actuary of the Clerical, Medical and General Life Assurance Society, who has kindly gone through Mr. Hoffman's statistics with me.

per cent. is high for persons without family predisposition or recognised tubercular disease, and would suggest inadequate selection. Still more is it fatal to the contention of the author that family predisposition is of little consequence when we find that this factor alone causes a mortality of 5·3 per cent., or 1·4 per cent. greater, within the short time of observation. And when we combine the male and female lives, the percentages become 3 for general and 5·5 for hereditary causes respectively. Mr. Hoffman would get out of the difficulty by saying that the family history cases were probably weaklings, and were subject to infection. But the 15,000 rejected for neither family nor personal consumption were undoubtedly weaklings or battered lives, and I have given some reasons to doubt how far the argument of person-to-person infection holds, apart from special predilection or experimental conditions.

I would now draw attention to some grave defects in our civilisation which tend to lower resistance to all diseases, and especially to tuberculosis, which are remediable, and which only require national determination and resourcefulness for their removal. I have shown how the mortality from consumption has fallen with generally improved sanitation and amendment of the conditions of life.

TABLE II.—ENGLAND AND WALES.

Deaths per 1,000,000 living, from various causes, Males and Females. Average of each five years from 1881 to 1900. Reg.-Gen. Rep., 1900, T. 18.

Average of each five years from 1881 to 1900.	1881—1885.	1886—1890.	1891—1895.	1896—1900.	Increase or Decrease.
All causes	19,403	18,695	18,701	17,703	−1,700
Measles	413	468	407	421	+ 8
Scarlet Fever	436	241	182	134	− 302
Whooping Cough	459	444	398	358	− 101
Diphtheria	156	169	253	272	+ 116
Enteric Fever	216	199	173	173	− 43
Influenza	4	34	415	308	+ 304
Starvation (want of breast milk)	15	10	11	12	− 3
Phthisis	1,830	1,635	1,461	1,321	− 519
Other forms of Tuberculosis, including Scrofula and Tub. Meningitis	421	421	420	385	− 36

A glance at this table will show you that the fall of the death-rate from consumption is, to at least a great extent, coincident and commensurate with the decline in mortality from other causes. The fight against consumption is only a part of a more general campaign, and whilst concentrating our attack upon a particular poison microbe we must co-ordinate it with the strategy of a larger battle-field.

Public opinion has now ripened to the view that a large percentage of the British race is dwindling in physique. Of the truth of this there can be little doubt, and but for the strenuous efforts of the public health departments, the rate of mortality would be appallingly on the increase instead of gradually declining.

Speaking in round numbers a sixth, or 16 per cent., of our population die before they arrive at the age of 12 months. It takes another 20 years for another sixth to pass away; again another 20 years for the next sixth, and again in another 10 years a further sixth.

TABLE III.—INFANT MORTALITY.

England and Wales.

Period.	Annual Mortality of Infants under one year of age per 1000 births.
1851—60	154
1861—70	154
1871—80	149
1881—90	142
1891—1900	154

London.

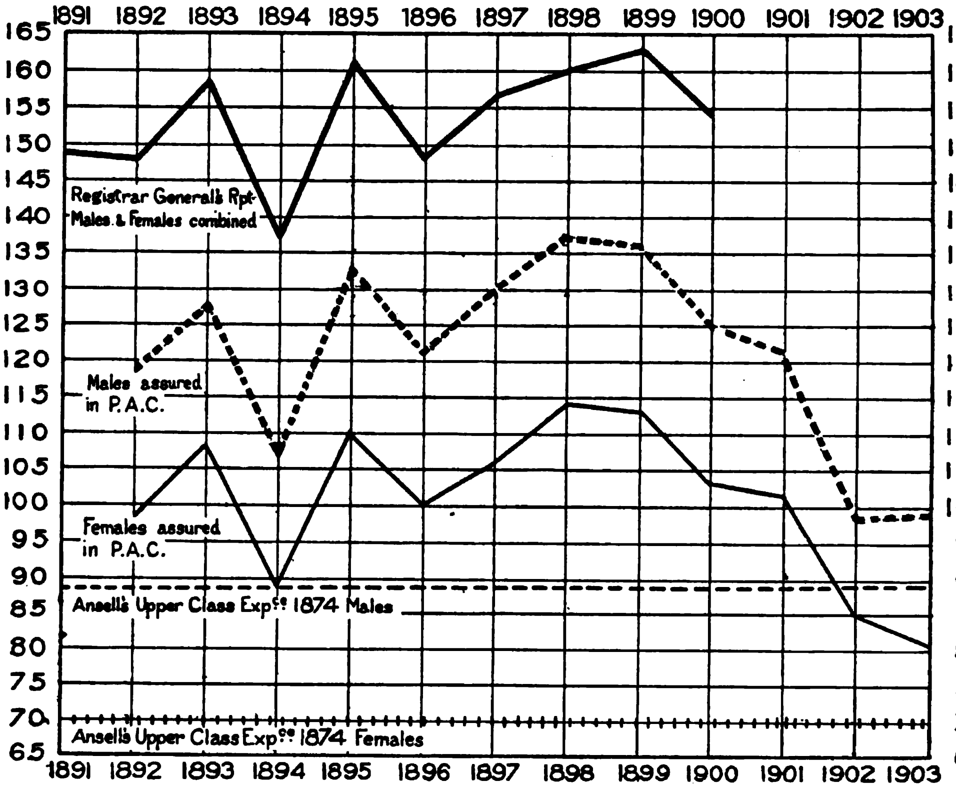
Period.	Annual Mortality of Infants under one year of age per 1000 births.
1841—50	157
1851—60	155
1861—70	162
1871—80	158
1881—90	152
1891—1900	160

One would, of course, expect a considerable death-rate in the first year, and especially in the first few days of life. Premature and difficult labours and unviable children are amongst the normal risks of that period. To what extent then is this enormous death-rate, which has not changed for 50 years, *abnormal, adventitious, preventable?* We hear much in protestation against the diminishing birth-rate in this country. Do we take sufficient, reasonable care of those that *are* born? And, what is more to the point, are the circumstances under which so large a proportion of them die such as to damage the lives of the survivors? The survival of the fittest is a conception only applicable in its brutality to wild life in the animal and vegetable kingdoms. If the game were fairly played, civilised life would be impossible.

I have had by the kindness of Mr. Whittall, the Actuary, and Mr. Collins, one of the chief clerks of the Life Assurance of which I have the honour to be a director, this diagram-chart drawn out, showing the death-rate per 1,000 of infants under one year of age during the ten years 1890–1900. The upper black line gives the general death-rate of males and females, and ranges as you will see between 137 and 163 per 1,000 as shown in Table 24, p. CIV. of the Registrar-General's Report for 1900.[15] Through the kindness of Mr. Frederick Schooling, actuary of the Prudential Assurance Company, Mr. Collins has been able to trace these

other curve lines, dotted and thin respectively, giving the rate of mortality amongst a large number, perhaps half a million, of infants under twelve months who have been insured by that society. It ranges from 106 to 137 per 1,000 for males, 89 to 114 for females. The notable downfall

Comparison of the Number of Deaths occurring among 1,000 Infants under one year of age, during the ten years 1890 to 1900.



Registrar-General's Report, 1901, page CIV.
Prudential Assurance Co.—Males . .
„ „ „ —Females . .

NOTE.—The lines at the lower part of the diagram (males ————, females ++++++++), refer to the rate of mortality experienced amongst infants in the Upper Classes, published by Mr. Charles Ansell, in 1874.

for 1902 and 1903 is attributable to the mild winter and cool summers, and will, I fear, not be maintained. Now, it must be remarked that the Prudential mortality, whilst being almost exclusively limited to the poor,

is more favourably influenced than the general mortality amongst that class by one or two facts. Firstly, they do not insure illegitimate children, and insurances are not usually effected until a month after birth, as the benefit of insurance is not received until three months have elapsed. The lines of mortality, however, as you see, exactly conform to those of the general mortality. An interesting work was written by Mr. Charles Ansell,[16] actuary of the National Life Assurance Society, in 1874, on statistics of families in the upper and professional classes, reckoned from probably some 20,000. From these statistics the straight dotted lines on the diagram are derived, showing the infant mortality below the age of one year at 89 per 1,000 for males, and 70 for females respectively. There have been no further statistics of the same kind since this laborious work of Mr. Ansell, and probably there would be an appreciable diminution now upon the upper class mortality of 1874. But the figures are at least in sufficiently striking contrast with those of the general infant mortality, and the, to a certain extent, selected and minimised death-rate amongst the more thrifty poor shown in the Prudential Assurance statistics. They may be said to represent the ideal rate. And, inasmuch as the general death-rate of the Registrar-General would, of course, include that of the upper classes, a margin of at least 60 or 70 per cent. would seem to be attributable to conditions connected with the insanitation of poverty, most of which is theoretically and much of which is practically preventable.*

Ansell shows by another table that the bulk of the mortality comes within the first few days. I know of no such table drawn from the Registrar-General's Reports, and it would be interesting to know how far they conform to it.†

Now the point I want to emphasize as deducible, amongst others, from these tables is, that a mortality of one-sixth amongst infants within the first year must necessarily mean a lowered vitality, a lessened viability and developmental power amongst the survivors. It is, I believe, reckoned

* In 1900 the proportion of deaths of infants under one year to registered births was 154 per 1,000, about equal to the average of the preceding ten years. Taking registration counties, however, it ranged from 79 to 100 in the rural counties of Rutlandshire, Dorsetshire, Wiltshire, and Oxfordshire; from 175 to 180 in Warwickshire, Notts., Staffordshire, and Lancashire, which include a large urban registration.

When we consider that whilst in 1861–71–81 the rural population of England and Wales had diminished in proportion to that in towns from $\frac{7}{12}$ to $\frac{6}{11}$, and that it had further diminished between 1881 and 1901 from $\frac{6}{11}$ to $\frac{7}{25}$, *i.e.*, from rather more than half to considerably less than one-third, we find reason, in this crowding of the population from rural into town districts, in part to account for the maintenance of the mortality rates amongst infants. It certainly speaks much for the zeal and resource of our Medical Officers of Health and the Boards whom they advise, that the mortality rate has not enormously increased.

† Dr. Templeman has contributed a valuable paper on the Causes of Infant Mortality to this Congress.

in war that for every man killed there are five or six wounded, and so with disease; conditions which kill 16 per cent., maim and stunt and make weaklings of at least a proportion of those that remain, and cause them to become further decimated or weakened by such diseases as rickets, measles, whooping-cough, bronchitis, and tuberculosis in early life. Thus we find of every 1,000,000 born but 680,033 remaining at the age of twenty, and of these survivors, our recruiting statistics tell us as to the percentage who are physically fit, *i.e.*, who come up to the standard required, and who can bear the wear and tear of the first year or two of a soldier's life.

But after the age of twenty what becomes of the 680,000 remaining of each million?

If we take the 680,000 general population surviving at age twenty, and compare their viability with that of an equal number of those selected as good lives for Life Assurance, we shall find the results recorded in this table, which has also been kindly drawn up for me by Mr. Collins (Table IV.). You will see that there are 12,000 less living amongst the general than the select population at thirty, 27,000 less at forty, 46,000 at fifty, 59,000 at sixty, 56,000 at seventy, and 29,000 at eighty. This is depicted by the curved lines and figures of the diagram (p. 363). Half of these deaths between twenty-five and thirty-five are from consumption.

TABLE IV., *showing the number of Survivors at each consecutive age of 680,033 lives aged 20.*

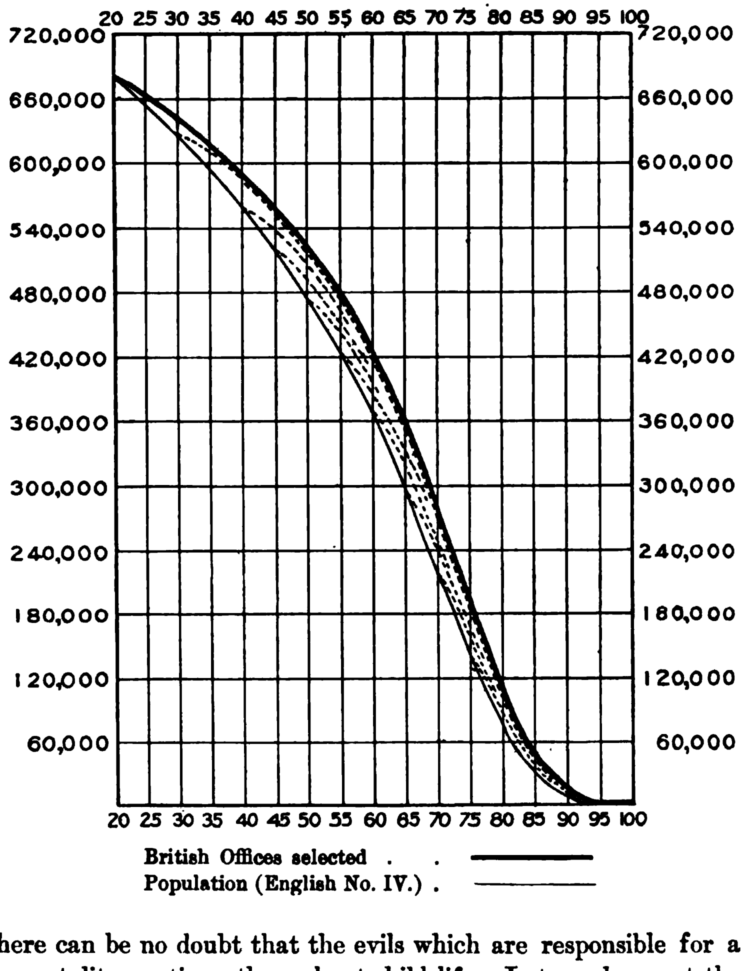
(*a*) Subject to the mortality ruling among assured lives ascertained by medical examination to be first-class at age 20, as shown by the British Offices Select Table.

(*b*) Subject to the mortality ruling among the general population, as shown by the English No. IV. Table.

Age.	(A) Select Assured Lives	(B) Population.	(A)—(B). Excess of Survivors of Select Lives.	Age.
20	680,033	680,033	......	20
30	642,600	630,038	12,562	30
40	590,410	563,077	27,333	40
50	523,410	476,980	46,430	50
60	424,980	365,011	59,969	60
70	278,160	222,056	56,104	70
80	107,260	77,354	29,906	80
90	11,284	8,015	3,269	90
100	49	82	33	100
Total 20 to 60	23,723,853	22,515,941	1,207,912	Total 20 to 60
61 to end	5,780,478	4,612,446	1,168.032	61 to end
Total	29,504,331	27,128,387	2,375,944	Total

Curves representing the number of Survivors out of 680,033 Assured Lives, selected by British Offices, at age 20; and a similar number of Lives of the General Population as indicated by the English No. IV. Table.

The abscissa represents the age and the ordinate the number of survivors at that age.



There can be no doubt that the evils which are responsible for a high infant mortality continue throughout child life. Let us glance at the chief of these with a view to hints at their prevention.

Overcrowding and insufficient air. I need not enlarge upon this well-known condition of ill-health and mortality intensifying all infantile diseases, lowering general vitality and resistance to all diseases, and especially fostering tuberculosis. The remedy for overcrowding is a problem, and a

stiff one, but not impossible of solution, for the legislature. It is being taken seriously in hand, I am glad to know, by this city of Glasgow. As traffic communication becomes more easy, we may expect factories to go further afield, and it should not be difficult, with more space and greater legislative insistence, to secure more ample room for those employed, and to leave more room for those left in the towns.

There is no doubt that squalid home conditions are the cause, as they are certainly also one of the results, of alcoholism amongst the poor, a potent factor in the incidence of phthisis.

Defective milk supply for infants and children is one of the principal causes of infantile mortality and impaired development. According to Mrs. Greenwood, an Inspector of the Medical Officers' Department of Sheffield in 1900, only 12 per cent. of the women suckled their children.[17]

The mother's milk, the best supply for children, is most generally defective or wanting owing to the poorness of her food or the exigencies of her work. With doctors, visitors, health officers, nurses, poor-law boards and the rest, methods and resources should be forthcoming by which these cases could be dealt with, the food of necessitous mothers supplemented, skilled advice given to them as to the best kind of food to take, more rest secured to them during the nursing period.

The source of the milk supply to our towns is not adequately inspected. Clean milk obtained with clean hands and forwarded in clean vessels and without fraudulent additions or removals is not obtainable by the poor. The poor probably pay a great deal more for the milk they get than the rich. Can it not be secured to them that they get at least what they pay for? There is no adequate punishment for that form of theft which takes the shape of devitalising milk, by depriving it of cream, diluting it with dirty water, and adding other fraudulent constituents. If these poor babies had votes, would their interests be better cared for? A Royal Commission of inquiry might even be instituted on their behalf.

Fifteen years ago a Royal Commission[18] did sit and drew something of a red herring across the line of better inquiry, by exaggerating the influence of tubercle bacilli in milk upon infant mortality, to the neglect of other more promptly fatal putrefactive and fermentative poisons and deprivations. And now another Commission is sitting to correct the exaggerated results of the first inquiry in the light of Professor Koch's statement that bovine tuberculous milk is of little consequence. The truth seems to lie between the two, and there is much room for a third Commission to inquire into the best manner of supplying pure milk to country and urban populations, at a fair price. Some noble

experiments are now being made in Paris, New York, Battersea, St. Helens, Liverpool, and Dundee, to supply from depots sterilised milk in clean bottles for infants. Mr. Watt Smyth[19] is to a certain extent right, although I think unnecessarily severe in his criticism of this most praiseworthy step, when he draws attention to the absence, in this country, of sufficient inquiry as to the source of the milk thus dealt with. A glance at the last Report on the Health of Battersea[20] will show that in the milk supply of that borough at least the contractor is bound by fairly stringent conditions, which include the supervision of the farms and the manner in which the milk shall be collected and transmitted to the depots. There can be no doubt that scientifically conducted dairy farms on a large scale, with urban depots for the reception and dispensing of pure milk in clean bottles at a fair price to the poor, would pay, and would be a most laudable employment of the municipal enterprise that is often devoted to matters of much less urgent public interest and importance. Apart from the primary benefit of affording a pure milk supply at a fair price, the object lesson to mothers and families in food cleanliness would be beyond price. It cannot be doubted that such an effort, carried out on purely business principles, graced by the benevolent spirit, would be supplemented by almoners' funds for the assistance of those in actual need. If, on the one hand, the maternal milk supply of the country were increased by the supply of extra food and the securing of extra rest to suckling mothers, and if, on the other hand, a pure milk supply were secured to the poor by a system of municipal or private trading, supplemented by some charitable funds for the most needy, the infants would at least get a fair start, the falling birth-rate, if not corrected, would perhaps be more than compensated for, and the death-rate from tuberculosis amongst children and at later ages would be notably lessened.

Passing to the later school life of children up to adult age, no one will question that we want more exact information. The general opinion,

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NOTE.—Careful and full details as to the best methods of running milk depots are given in Mr. Watt Smyth's valuable work, and Dr. McLeary,[22] the Medical Officer of Health for Battersea, has recently contributed to the *Journal of Hygiene* an interesting article on the History and Function of the Infants' Milk Depot, which seems to have been started in Paris by Dr. Budin, in 1892, and extended to 60 French towns. The system has been tried in New York since 1893, at St. Helens, 1899, Liverpool in 1901, Battersea, 1902, Leith and Bradford, 1903.

Prof. Budin's system, justly praised by Mr. Smyth, is, it must be noted, a hospital system. The Battersea depots (and I take it the others also) are municipal systems. There is at Hampstead[21] a system for infant milk supply, also on hospital lines.

which I believe from observation to be correct, is that children's brains are being overworked and over worried, their characters but poorly cared for or developed, their bodies under-fed and under-exercised. Much sincere and honest thought is being given to this question, however, and with patience and further experience I believe it will be solved.

For Board Schools there are two considerations that seem to be of fundamental importance, and towards the acceptance of which public opinion is ripening, firstly, that as every child is now educated at the expense of the State, so a part of that education should be directed to fit him physically and morally for a citizen's service in the State, *i.e.*, to rear sound children and to defend them if necessary. The boys want education in physical exercises, to be carried out in the open air or in open sheds, calculated to develop their chest and limb power, and their capacity to handle tools and weapons. They need discipline to teach them cheerful obedience, self-control, respect for themselves and for others. Secondly, the physical part of their instruction should be so timed that a meal should be served afterwards, to be arranged by a cost payment for those who can pay, by allowance for those who cannot. And during this meal time the children should be under the discipline and example of their physical instructors. The girls should be taught cooking, cleaning, and how to rear children. By devoting a part of school life to learning these things we should become a still more upstanding race, the evils and corruptions that beset all ageing civilisations would be held at bay, and with increased vigour from more systematically developed frames, the resistance to the inroads of tuberculosis would be increased, and that disease would find fewer ready victims.

I have dwelt at, I fear, too great a length upon the general conditions upon which the prevention of consumption is based. They are inextricably mixed up with the specific cause of tuberculosis.* I shall now be able much more briefly to allude to specific measures of a preventive kind.

It is in darkness and filth that tubercle flourishes. Let each and every person in this assembly preach and illustrate the gospel of cleanliness and temperance, to keep the dwelling airy and cleansed from all dust and garbage, and each will be the nucleus of a falling death-rate from consumption. There is unquestionably a very great deal of tubercular material, bacillus-containing dirt, about our streets and public places of resort that need not be there. If no person, and especially no consumptive person, would ever contaminate his surroundings with ex-

* See Paper by Sir R. Temple on "Measures for the Prevention of Malaria and Tuberculosis in the Andaman Islands," read before this Congress.

pectoration, an enormous reduction in the amount of active dangerous poison would at once take place.

Certain special precautions are necessary in the self-management of consumptive patients. They may be summed up in simple directions. Use proper spitting receptacles as advised by the doctor, learn to save coughing for convenient times, and always hold a handkerchief before the mouth when coughing. Preserve generally the utmost personal and room cleanliness.

It is certainly necessary that a keener supervision, and with more authority, should be exercised by our sanitary medical officers and their inspectors with regard to the cleanliness of public places of resort, vehicles, hotels, public houses, lodging houses.* It is, for instance, appalling to the sanitarian to notice the average conditions of our local and suburban railway carriages, and to note how the poisonous dust is raked up and distributed about by the porter's brush, and the remnants of dusty filth scattered about the platforms. No adequate cleansing instrument has yet been invented to replace those barbarous weapons, the housemaid's broom and the porter's brush. It is not the tubercle bacillus alone, but the general organic filth that renders it impossible for those with incipient or arrested phthisis to live in town conditions and to resume office work.

Voluntary notification of consumption should be encouraged in all municipalities, and there should be a thoroughly good feeling cultivated by the district medical officer† and his practising colleagues for their mutual educational benefit, and for the advantage of the community they serve. The whole sanitary control of a district must be in the hands of the medical officer of health, but his work will be to a great extent paralysed if he have not the cordial co-operation of his confrères, the medical practitioners of the district. Each medical man should be the adviser of his own clientèle, and in all cases of sanitary difficulty he should have the advice and authority of the health officer at hand.

Early diagnosis of tubercular disease is of the utmost importance to the individual and to the public, and facilities for the bacteriological investigations should be within easy reach of every medical man, gratuitously for the poor, at a moderate fee for the better-to-do.

There should be a Sanitary Association in every district for the consideration and discussion of all local questions of public health.

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* I am glad here to testify to the admirable cleanliness and sanitation of the public tram cars of Glasgow, and the downright intimation in each of them that "spitting is forbidden."

† An able address by Dr. Newsholme, already alluded to, gives valuable hints on the duty of family practitioners in relation to phthisis.

The principles of sanatorium treatment are so well known that I will not dwell upon them. They are all calculated for the prevention as well as the cure of the disease. They consist briefly:

1. In the preservation of aseptic surroundings for the patients.
2. In securing the natural antiseptic qualities of air and sunlight which are not expended in the oxidation of organic impurities.
3. All measures of regulated rest, abundant and selected food, and regulated exercise are adopted, calculated to fortify the resistance and strengthen the natural anti-microbic powers of the patient.

As yet little or no more direct therapeutic treatment has been adopted at sanatoria.

As a means of prevention, or diminishing the death-rate from tuberculosis, the effect of sanatoria has as yet been quite insignificant, for the reason that their adoption for the treatment of the poor has not as yet been organised. It is from the poor and crowded populations that the vast death-rate from consumption arises, it is from them that the great bulk of poison material emanates. Yet measures for the treatment of consumption amongst them are still ludicrously inadequate. Under the influence mainly of tuberculophobia at the present time, general hospitals are shy of taking in tuberculosis, convalescent institutions are refusing to receive them, special hospitals have such long lists waiting that they do not receive them in time, and injunctions are frequently sought against the occupation of suitable sites for building more sanatoria. Local efforts on a microscopic scale are here and there started by benevolent people, but they must serve as the mere nuclei of example and encouragement for larger efforts undertaken by municipal authorities throughout the kingdom, before they can effect any notable improvement in the prevalence and death-rate from consumption.

Our great hospitals are not doing their duty in this matter. If a conference were held between the representative authorities of all the great hospitals in each district of the kingdom, a means might be found by which a small percentage of beds could be set apart under special conditions for the reception from the neighbourhood of early consumptive cases for diagnosis and treatment to be drafted on to country branches for sanatorium treatment.* This must be supplemented by proper infirmary accommodation for advanced cases.

* This is being done on a small scale by the Middlesex Hospital. For an interesting report of a "Hospital's Committee," appointed by the Westmoreland County Council to investigate this question of providing accommodation for consumptives, see leaflet pub-

There are already several homes scattered about for the treatment of advanced cases of consumption. What is wanted is a small home in connection with each county according to its population. This would probably mean but little more than a better use of the expenditure that already directly or indirectly burdens the rates through this disease.

The maintenance of the families and the after care of poor consumptive patients is a great and a difficult problem. But it is not an insoluble one. The problem remains unfaced at present, but consumption is very expensive to the rates, and more might be done without much, if any, more expenditure. Benefit societies, wielding enormous sick assurance funds for the poor, would find it to their advantage to co-operate for the maintenance of the families. Industrial insurance societies would find a means to co-operate in some way towards the same end. As pointed out by Dr. Hoffman[25] in the valuable paper to which I have alluded, direct contribution to the sanatorium treatment of the assured who become ill from tuberculosis is impossible except, as in Germany, where the insurance is by the State. The companies have no funds for charitable purposes, yet, as pointed out by Dr. Hoffman, some half-million dollars a year are lost by the American Prudential Assurance Society by the consumption death-rate alone. A portion of such loss would go some distance towards reassurance for diminished death-rate and increased longevity. There is no doubt too that a much larger loss is saved by the lapse of industrial insurance policies through inability of invalids to keep up the premium payments; and if means were devised on any considerable scale for maintaining policies amongst those of the industrial classes who become tubercular, it would become still more the interest of such insurance societies to co-operate in the treatment of such cases. An interesting experiment, to which I can only here briefly allude, has been proceeding in Germany since 1881, when the Emperor William I. first inaugurated a system of State insurance. Under this system the State, the employer, and the workman each contribute in equitable proportions towards insurance against sickness, accident, and old age. An essential condition is that the contributions by all three participators are compulsory. Under this scheme, amongst other advantages, funds are forthcoming for the maintenance of families during the sickness of the breadwinners. The system of insurance has naturally also stimulated hygienic supervision, and from this and other causes the

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lished by the National Association for the Prevention of Consumption, reprinted in Appendix VI. of Dr. Hillier's work. It is impossible to deal, with even approximate accuracy, with this large subject in the course of one lecture. It has been skilfully and suggestively handled by Dr. Hillier in his above quoted work.

death-rate from consumption has fallen in Germany since 1886 from 31 to 19 per 10,000. It will probably be long, however, before any system of this kind will recommend itself to the British workman.

Much has been said and done with regard to the distribution of leaflets and pamphlets broadcast as an aid to the prevention of consumption. I must say that it is my belief that on the whole this scattered literature has done more harm than good, by spreading panic through misconception or exaggeration, and that the end would be best served by limiting such to authentic and uniform information, to be obtained from the Health Officers by medical practitioners of their districts, for distribution to the heads of the families where the disease is prevalent. Some unfortunate and ludicrous instances of "tuberculophobia" are given by Dr. Bulstrode in his Milroy Lecture,[26] and others have come within my own experience.

The Medical Officer of Health can scarcely fail to be aware, and can be always informed by private notification of consumption prevailing in definite centres, and has, or should have, control over public places and houses.

Again, it would be the clear duty of a private medical man if case after case of consumption were, as sometimes happens, to come under his cognizance in a given house, to notify the fact to the Medical Officer of Health. And if a poor man have a case of consumption in his house, and has not the means to carry out the hygienic arrangements desirable, he would be advised by his doctor to seek the help of the Medical Officer of Health, who would have powers from public or charitable sources to give him that help in the way of nursing, supervision, cleansing, disinfectants, etc. In this way and degree voluntary notification or action upon public information is of course legitimate and right. Beyond this I do not see that the liberty of the subject can wisely or advantageously be intruded upon. It is, of course, a large question, but in the first place practical steps could not be taken upon compulsory notification* in the way of isolation, unless the community were prepared permanently to support all wage-earners or salaried persons who are ousted from their occupations. Very possibly, some—I think very slight—diminution of phthisis mortality might be effected by so drastic a measure, but at much too great a cost to the community in many other ways.

Dr. Tatham,[28] in an able memorandum to the Congress on tuberculosis, shows that not only has there been an absolute saving of life from

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* Dr. Newsholme thinks compulsory notification "certain to come." Its enactment, as at Sheffield, *i.e.*, for information, cleansing, and disinfection, is as far as he thinks practicable, however.[27]

consumption of about 50 per cent. in the past fifty years, but that there has been a postponement of the chief mortality by some ten or fifteen years, and that the saving has been greater amongst females than males.

If we look, however, to the difference between the rate of decline between the first half, 1851–80, and last half, 1880–99, of that period, we find that the rate has not been so well maintained since the discovery of the tubercle bacillus in 1882 as we might have hoped for. There are no doubt some fallacies to partly account for this, but accepting the broad fact, it may be accounted for, in the first place, by the increasing flux of the population into the towns the last twenty years, and by defective general hygiene attendant upon overcrowding. It may be due, secondly, to those measures indicated by the discovery of the specific nature of the disease not having been adequately developed.

I have shown that further perseverance in general hygiene is necessary, and I have brought forward arguments to show how inextricably these general measures are mixed up with those special to the microbe. All measures of hygiene have contributed, and do contribute, to the prevention of consumption: by fortifying the host; by minimising the parasite. Can we do more, and are we attempting to do so on the right lines?

I have shown that our measures for sanatorium treatment are on right lines, educative, administrative, curative. But these measures are in their infancy. The co-operation of our poor law and municipal authorities, charitable organisations, sick benefit and industrial and sick assurance societies, must be sought in a matter in which they have interests and great responsibilities.

The public health departments are doing much, and may do more, by the establishment of bacteriological laboratories in every borough, and by more strictly supervising public and licensed places, and by approaching and instructing the heads of afflicted families through their medical advisers.

Our hospitals and infirmaries are not doing their share in dealing with tubercular diseases.

Voluntary notification is of value in helping the medical officer of health in his arduous work. Compulsory notification, strongly advocated by some authorities, and adopted in some places in this country and abroad, seems to me to be impracticable. Rigidly carried out it would be a tyrannous measure, calculated to raise popular resentment against hygiene in general. We may, by these various measures, expect the prevalence and virulence of the tubercular poison to be on the one hand indefinitely attenuated, and on the other hand we may expect immunity to

be increased as a more robust public vitality develops from better life conditions and improved physical training. Further, as the disease becomes less prevalent, there will be fewer persons to transmit hereditary delicacy and to spread the elements of infection. Thus in time we may hope to see consumption reduced to a mere fractional remnant of its already diminishing prevalence.

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OBITUARY.

SIR JOHN SIMON.

The last of the early fathers of administrative sanitation in England has passed away, and although his official career ended nearly thirty years ago, the work that he accomplished is still valued as a basis upon which modern sanitation rests.

John Simon was born in London, on October 10, 1816, of Anglo-French descent, his grandfathers, who were both Frenchmen, having married English wives. He went, in the first instance, to a preparatory school at Pentonville, and then to a school at Greenwich, kept by Dr. Burney, a nephew of Mme. D'Arblay, with whom he remained between seven and eight years. He was next sent as a pupil into the family of a German pastor at Hohensolms, in Rhenish Prussia.

After ten months spent at Hohensolms, it was decided that he should enter the medical profession, and in 1833 he was placed as a pupil with Mr. Joseph Henry Green, then Surgeon to St. Thomas's Hospital and Professor of Surgery at King's College. His ability and industry were from the first conspicuous, and he became a member of the Royal College of Surgeons in 1838. In 1840, on the opening of the new King's College Hospital, he was appointed assistant surgeon, and, in 1845, after the communication of a paper on the comparative anatomy of the thyroid gland, he was elected a Fellow of the Royal Society. In 1847 he became Professor of Surgery at St. Thomas's Hospital, and so renewed with that institution a connexion which had begun when he was a pupil, and which was severed only by his death.

In July, 1848, Simon married Miss Jane O'Meara, and in the same year he was elected to the newly-constituted post of Medical Officer of Health to the City of London. The qualities of mind displayed in his official reports as Medical Officer of Health for the City, reports in which he laid down the principles upon which alone any public sanitary administration can repose with safety, led the Government, in 1855, to offer him the newly-created post of Medical Officer to the Privy Council. After some consideration, the offer was accepted.

On his appointment to be Medical Officer of Health to the City of London in 1848, the chief subjects requiring his attention were the water supply of the City, the offensive or injurious trades carried on within its limits, the intramural interments, the impossibility of ventilation in its blind alleys and courts, and the lack of proper scavenging.

The reports made as Health Officer to the Privy Council cover a wider area of observation than those made as Health Officer to the City; and they are, in their essential nature, consecutive and complementary to each other, although it was the author's custom sometimes to quote a demonstration or an argument which he had supplied or advanced on a previous occasion. In an article written for Quain's "Dictionary of Medicine," he clearly laid down the theory that contagious emanations proceeding from the sick must consist of definite particles, since they obeyed the laws of definite particles and no others; and that these particles must differ among themselves, being in every case peculiar to the disease which alone produced them, and which alone they could reproduce. This theory has since received its proof and its complete development in the growth of the science of bacteriology; but, before the disease-producing bacteria had been either identified or cultivated, Simon saw that the theory, if established, would greatly increase the definiteness and the success of measures of sanitary reform; and he diligently pursued any lines of investigation by which its correctness might be tested.

His reports—which are really State papers of high importance and of perennial interest—were rescued from the living death of interment in old blue-books by The Sanitary Institute, and, together with the reports to the City, long reports on the History and Practice of Vaccination, and with essays of great value upon contagion and upon experiment as a basis of Preventive Medicine, were published in two volumes with the assistance of the author, and under the editorship of Dr. E. Seaton. These volumes show the general nature of Simon's work, and the spirit with which he addressed himself to the removal of the evils against which it was his official duty to contend.

In the early part of 1876 he resigned his office, and was succeeded by his old friend and colleague, Dr. Seaton. Simon himself received the C.B. on his retirement, and was appointed a Crown Member of the General Medical Council. He was made a K.C.B. at the Jubilee of 1887.

He retired from the Medical Council in 1895, and passed the remainder of his honoured old age at the house in Kensington Square which had been his home for many years, and where he died on July 23rd.

A fuller account of his work and writings will be found in the volumes already referred to,* and also in his great work on "English Sanitary Institutions," published in 1890.

* Public Health Reports, by John Simon. 2 vols., 8vo. The Sanitary Institute and J. & A. Churchill. 1887.

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT BRADFORD CONGRESS.

The following decisions have been made since the list was published in Vol. XXIV, p. 855:—

RECOMMENDATION MADE IN THE CONFERENCE OF MUNICIPAL REPRESENTATIVES—

"That the amendments suggested in Dr. Eustace Hill's paper on 'Suggested Amendments of the Housing of the Working Classes Act, Part II.,' be referred to the Council of The Sanitary Institute for consideration and report, and that the Council of The Sanitary Institute be requested to ascertain the views of County Councils and Councils of County Boroughs throughout the country as to the emendation requisite in Part II. of the Housing of the Working Classes Act, and to take such action thereon as may seem to them desirable."

The Council decided that no effective action could be taken in the matter.

RECOMMENDATIONS PASSED AT THE CONFERENCE OF SANITARY INSPECTORS—

"This Conference of Sanitary Inspectors respectfully ask the Council of The Sanitary Institute to take into its early consideration the question of admitting (as Members of the Institute) any Sanitary Inspector who has held office as such for a period of ten years, who shall have either passed the Institute's Examination for Sanitary Inspector, or that of the Metropolitan Examining Board, at the reduced annual subscription of one guinea."

After careful consideration, the Council decided not to adopt such a rule with regard to the election of Sanitary Inspectors as Members of the Institute.

"That this Conference of Sanitary Inspectors, realising the difficulties that occur owing to the limited definition of the word 'drain,' ask

the Council of the Institute to exercise its influence with the Government with a view to obtaining an extended definition of the term in question as provided in Section 42 of the West Ham Corporation Act of 1898."

The Council decided that in view of conflicting decisions, this question requires dealing with as a whole, and should, in the opinion of the Council, be fully considered and dealt with in a general Act in which proper provision can be made. The Council will, however, be glad to support this when an opportunity arises.

"That this Conference of Sanitary Inspectors is of the opinion that the law relating to the Sale of Food and Drugs requires amending, so as to enable an officer to procure samples of articles consigned to his district at any place of delivery beyond the limits of such district, and, further, empower such officer to institute all like proceedings as if such places were within the district for which he is appointed, and therefore ask the Council of The Sanitary Institute to petition the Government in favour of such an amendment."

The Council decided to omit the words "and, further, empower such officer to institute all like proceedings," and that the resolution, with this amendment, be accepted and forwarded to the Local Government Board.

NOTES ON LEGISLATION AND LAW CASES.

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For full text of these see Law Reports, which can be referred to in the Library of the Institute.

ADULTERATION.—*Food and drugs—Institution of prosecution—Sale of Food and Drugs Act, 1899 (62 & 63 Vict. c. 51), s. 19, sub-s. 1.*

By s. 19, sub-s. 1, of the Sale of Food and Drugs Act, 1899, a prosecution under the Sale of Food and Drugs Acts "shall not be instituted" after the expiration of twenty-eight days from the time of purchase:—

Held, that the laying of the information, and not the service of the summons, was the institution of the prosecution. BEARDSLEY *v.* GIDDINGS. Div. Ct. [1904] 1 K. B. 847.

BUILDINGS.—*Drainage of houses on low-lying land—London Building Act, 1894 (57 & 58 Vict. c. ccxiii.), s. 122.*

Land is "so situate as . . . . to admit of being drained by gravitation into an existing sewer" within the meaning of s. 122 of the London Building Act, 1894, if it is situate at such a level that the drainage from it will find its way by gravitation into the sewer under the ordinary conditions of the sewer, although during a substantial number of days in the year that drainage is in fact prevented from passing into the sewer by reason of the sewer becoming surcharged with rain-water and of the pressure of that water inside the sewer closing a flap or valve at the inlet of the sewer. ELLIS *v.* LONDON COUNTY COUNCIL. Div. Ct. [1904] 1 K. B. 283.

DRAIN OR SEWER.—*Pipe draining several houses belonging to different owners "Single private drain"—Local Government—Public Health Act, 1875 (38 & 39 Vict. c. 55), ss. 4, 41—Public Health Acts Amendment Act, 1890 (53 & 54 Vict. c. 59), s. 19.*

Where two or more houses are drained by a single pipe, neither the fact that the pipe is wholly situate on private land, nor the fact that the houses belong to different owners, will suffice to make the pipe a "single private drain" within the meaning of s. 19 of the Public Health Acts Amendment Act, 1890, so as to entitle the local authority, in the event of the pipe becoming a nuisance, to require the owner or occupier of the premises to amend it under s. 41 of the Public Health Act, 1875.

Semble, the words "belonging to different owners" in s. 19 of the Act of

1890, mean "not all belonging to the same owner." In order to bring a case within the section it is not necessary that all the houses should belong to different owners. THOMPSON *v.* ECCLES CORPORATION. Div. Ct. [1904] 2 K. B. 1.

FACTORY.—"*Tenement Factory"—Fire-escape—Factory and Workshop Act, 1901 (1 Edw. 7, c. 22), ss. 14, 149.*

By s. 149 of the Factory and Workshop Act, 1901, the expression "tenement factory" is defined to mean "a factory where mechanical power is supplied to different parts of the same building occupied by different persons for the purpose of any manufacturing process, etc.:—

Held, that by the words "is supplied" must be understood "is supplied from the same source," and that a building the parts of which, being occupied as factories by different persons, have each their own independent supply of mechanical power, is not within the definition.

Toller v. Spiers & Pond, Ltd. [1903] 1 Ch. 362, followed. BRASS *v.* LONDON COUNTY COUNCIL. Div. Ct. [1904] W. N. 102.

NUISANCE IN RESPECT OF DRAINS.—*Order to abate—Necessity for signature by two justices—Public Health Act, 1875 (38 & 39 Vict. c. 55), s. 96.*

An order of a Court of summary jurisdiction under s. 96 of the Public Health Act, 1875, must be signed by two justices. WING *v.* EPSOM URBAN DISTRICT COUNCIL. Div. Ct. [1904] 1 K. B. 798.

SMALLPOX HOSPITAL.—*Quia timet action—Evidence—Admissibility—Injunction refused—Public health.*

The theory of the aerial convection or dissemination of the disease of smallpox has not received the unequivocal sanction of medical science; and the establishment of a smallpox hospital, properly conducted, is not of itself necessarily such a serious source of danger to persons resident, working, or passing by in its immediate vicinity—say, a radius of 50 feet—as to constitute a public or a private nuisance for which an injunction will lie in a quia timet action.

In such an action evidence is admissible to show what has occurred in the neighbourhood of other smallpox hospitals carried on under similar conditions, per Cotton L.J. in *Hill* v. *Metropolitan Asylum District* (1879) 42 L. T. 212; approved on appeal (1882) 47 L. T. 29, per Lord Selborne, dissentiente Lord O'Hagan. *Sed quære*, whether the admission of such evidence is not wrong in principle as raising a number of side issues on which it is impossible for the Court to adjudicate without injury to absent parties. ATT.-GEN. *v.* NOTTINGHAM CORPORATION. Farwell J. [1904] W. N. 55; [1904] 1 Ch. 673.

SMOKE.—*Chimney of private dwelling-house—Club—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 24 (b).*

By the Public Health (London) Act, 1891, s. 24 (*b*), "any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance" is declared to be a nuisance liable to be dealt with summarily under the Act.

A club of 750 members, managed by a committee of the members, had for many years occupied premises which had previously been a private dwelling-house; the premises comprised the ordinary accommodation of a club, and there were five bedrooms for the use of the members and eight for the club staff. In the basement were cooking ranges, a large roasting grate, and a vertical boiler with furnace attached, which latter were used for heating the premises; the smoke from all of them was discharged into one flue or chimney, which sent forth black smoke in such quantity as to be a nuisance. A summons against the respondent, the club secretary, for making default in complying with a notice of the local authority requiring him to abate the nuisance was dismissed by the magistrate on the ground that the chimney was the chimney of a private dwelling-house:—

Held, that the dismissal of the summons was wrong; that the premises as such were not a private dwelling-house within the meaning of the section, and that the respondent ought to have been convicted of the offence charged.

McNair *v.* Baker. Div. Ct. [1904] 1 K. B. 208.

——— "*Chimney*"—*Chimney sending forth black smoke—Funnel of steam tug—Specification in order of works to be executed—Local Government—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 5, sub-s. 5; s. 24, sub-s. (b).*

By s. 24 (*b*) of the Public Health (London) Act, 1891, "any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance" is liable to be dealt with summarily:—

Held, that the funnel of a steam-tug was a chimney within the section.

An abatement or prohibition order is not bad because it does not, under s. 5, sub-s. 5, specify the works to be executed for the purpose of abating or preventing the recurrence of the nuisance, although the person on whom the order is made may have required them to be specified. Tough *v.* Hopkins. Div. Ct. [1904] 1 K. B. 804.

URINALS.—*Power to provide sanitary conveniences—Local government—Public health—Sanitary authority—Subsoil of road—Vesting in sanitary authority—Misuse of statutory powers—Injunction—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 44.*

By the Public Health (London) Act, 1891, s. 44, sanitary authorities have

power to provide public sanitary conveniences in situations where they deem the same to be required, and to defray the expense of providing the same, and of any damage occasioned to any person by the construction thereof. And for the purpose of such provision the subsoil of any road, exclusive of the footway adjoining any building, is vested in the sanitary authority.

A sanitary authority constructed in the middle of a street (partly in the subsoil belonging to the plts. as owners of a house at the side of the street) underground conveniences, with underground approaches or subways having an entrance on each side of the street by means of a staircase. The subways could be used for the purpose of passage from one side of the street to the other, and were of greater width than was necessary for the purpose of approaches to the conveniences. The sanitary authority had no statutory power to construct subways:—

Held, on the evidence (differing in this respect from Joyce J.), that the primary object of the sanitary authority in constructing the approaches was that they might be used as a subway for passage from one side of the street to the other, and that consequently they had exceeded their statutory powers and ought to be restrained by injunction.

Decision of Joyce J. [1902] 1 Ch. 269, reversed.

Per Vaughan Williams L.J.: *Semble*, that s. 44 does not vest in the sanitary authority so much of the subsoil as could possibly be used for the purpose mentioned, but that if the sanitary authority do in fact use the subsoil for that purpose the subsoil so used vests in them.

Semble, also, that the sanitary authority have not to pay compensation to the landowner for the subsoil which they use. London and North Western Ry. Co. *v.* Westminster Corporation. C. A. [1904] W.N. 67; [1904] 1. Ch. 759.

VIBRATION.—*Noise—Electric generating station—Borough council—Statutory powers—Provisional Order under Electric Lighting Act—Construction of works—Temporary nuisance—Injunction.*

The defts., a borough council, acting under a provisional order, erected an electric generating station in proximity to houses of which the plts. were lessees and occupiers. The order provided that nothing therein should exonerate the undertakers from the action for nuisance in the event of any being occasioned by them. In an action for an injunction it was admitted that the vibration caused by the defts'. machinery constituted an actionable nuisance unless it was excusable upon the ground of being merely temporary. The defts. alleged that the nuisance could be removed in time by experiment and alteration of the machinery; and contended that until the machinery was perfected the construction of their works was not complete, and the action would not lie against them:—

Held, that the nuisance was not temporary, nor were the defendants to be

excused within the principle laid down in *Harrison* v. *Southwark and Vauxhall Water Co.*, [1891] 2 Ch. 409; and that the defts. were not entitled to carry on their works unless or until they could do so without creating a nuisance. An injunction was granted during the continuance of the plts'. leases.

One of the plts. had granted a sub-lease for the remainder of his term less the last three days thereof:—

Held, that he was entitled to an injunction in respect of injury to his reversion. Colwell *v.* St. Pancras Borough Council. Joyce J. [1904] W. N. 40; [1904] 1 Ch. 707.

WATER *for domestic purposes—School—Water company—Waterworks Clauses Act, 1847 (10 & 11 Vict. c. 17), ss. 48, 50, 53—Waterworks Clauses Act, 1863 (26 & 27 Vict. c. 93), s. 12.*

The defts., who were the occupiers of a school within the district supplied by the plts., demanded a supply of water for domestic purposes, but refused to comply with the regulations made by the plts.:—

Held, that the school was a dwelling-house within the meaning of the Waterworks Clauses Acts, and that although a business was carried on there the defts. might still be entitled to a supply of water for domestic purposes, but that they must first comply with the reasonable regulations for that supply which the plts. were entitled to make.

Pidgeon v. *Great Yarmouth Waterworks Co.*, [1902] 1 K. B. 310, commented on. South-West Suburban Water Co. *v.* St. Marylebone Union. Buckley J. [1904] 2 K. B. 174.

WATER-CLOSET ACCOMMODATION.—*Lodging-house—Validity of By-law—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), ss. 37, 39.*

A by-law with respect to water-closet accommodation made by the London County Council under the provisions of s. 39, sub-s. 1, of the Public Health (London) Act, 1891, required the landlord or owner of any lodging-house to provide and maintain in connection therewith water-closet, earth-closet, or privy accommodation in the proportion of not less than one water-closet, earth-closet, or privy for every twelve persons, and a penalty was provided for any offence against the by-law:

Held, that the by-law was unreasonable and bad, because it contained no provision for giving notice of the requirements of the sanitary authority to the person against whom it was contemplated that proceedings should be taken for breach of the by-law.

Nokes *v.* Islington Corporation (No. 1). Div. Ct. (1903) 610.

GENERAL NOTES.

REPORT ON THE EDUCATIONAL CONFERENCE HELD AT BRADFORD, JUNE 30TH TO JULY 2ND.

By Alice Ravenhill.

The Conference assembled for six meetings, in the course of which ten groups of subjects were discussed. Of these, three were directly concerned with hygiene: (1) The physical condition of children and school hygiene, (2) Child study, (3) The need for nursery schools; while in three more the hygienic aspects of the subjects were freely introduced: (*a*) The application of Froebel's principles to the education of boys and girls from five to twelve years of age, (*b*) Co-education, (*c*) The place of handwork in the school curriculum.

Perhaps the most impressive feature of the largely attended conference (3,000 tickets were issued) was the prominence assigned, and repeated reference made, to hygiene in education, including the importance of training all children into habits of intelligent co-operation in sanitary measures by definite instruction in the mechanism and requirements of the body. For example, the Dean of Durham (Dr. Kitchen), when speaking on the "Co-ordination of Schools," referred to the great need "for more thorough school instruction in the moral questions connected with the great social problems of the day, a preliminary to which should be making children understand the thing they live in."

Dr. Kerr (London County Council Education Department) read a useful paper on "The physical condition of school children." He stated that the result of recent and reliable investigation shows that one-third of the children in elementary schools have some kind of undesirable defect. Of these a low percentage are congenital or accidental, a high percentage are preventible; the chief causes being ignorance, dirt, and drink, though due allowance must be made for the results of acute poverty. Adequate ventilation, avoidance of fatigue, suitable and sufficient physical exercise, systematic medical inspection, and the support and assistance of inspectors and well-trained teachers, constitute, in Dr. Kerr's opinion, some of the most important agencies in promoting healthy conditions in schools.

Dr. Hall (Leeds) reported the outcome of his recent investigations on the physical conditions of poor Board School children. He gave full particulars of the gain to such children of one full meal a day, and furnished statistics as to the superiority in height and weight of Jewish as compared with Gentile children, owing to more maternal care and to a more nutritive diet. Dr. Hall advocated the compulsory feeding of children by their parents, even to the taxing of wages for the purpose prior to payment; the State to be responsible where evidence of poverty released parents from this obligation.

Dr. Helen Wilson (Sheffield) gave a report of her physical examinations extending over a term of years, of girls in a large secondary school: sixteen per cent. had errors of refraction; twenty per cent. showed enlarged tonsils or adenoids, and in eleven per cent. hearing was defective. Of 167 girls only forty per cent. had good teeth. Her facts proved the value of medical inspection. Dr. Wilson regretted the indifference of parents on the subject, even when the necessity for immediate remedial measures was laid before them.

Miss Alice Ravenhill (London) pointed out the sociological significance of school hygiene; the hindrance to teachers' efforts which exists in the apathy of parents, and the want of knowledge of local authorities; and the opportunities offered in a well-managed school for grounding all children, equally in primary and secondary schools, in the general principles of hygiene.

At the Conference on "Child Study" Miss McMillan (London) spoke on "Fatigue," giving useful applications in illustration of her points.

Miss Findlay (Southlands Training College) contributed a *résumé* of some enquiries she has conducted with the object of testing mental development, and how it is promoted by school education in children from 8 to 12.

Mr. J. C. Hudson (British Child Study Association) dealt with the necessity for, and assistance from, the application of scientific methods to any study of the health of children.

The meeting on "Nursery Schools" was essentially practical in spirit, and led to immediate results at Bradford. The physiological needs of very young children, and the results of their neglect, were forcibly but moderately discussed by Mrs. Miall (Leeds), Miss Phillips (Inspector, London County Council Education Department), and others. The main points emphasised were: (1) the injurious effects of subjecting "infants" to anything analogous to ordinary school routine; (2) the desirability of arranging suitable rooms and outdoor playgrounds for small numbers under experienced teachers, so long as babies of three to five were received as scholars; (3) the importance of entrusting all "inspection" of young children to suitable women; consequently the immediate necessity of securing the appointment of more women inspectors of schools; (4) the routine engagement of a trained nurse, or a highly qualified attendant, to care for and report on the physical needs of the children.

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